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General Motors Corporation

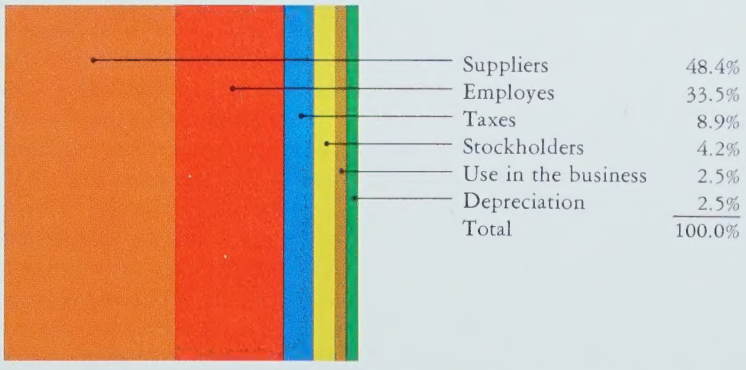
Annual Report for 1973


Cadillac
GMC
9500 DIESEL
12 14 DELCO 16
REGAL
BUICK
Chevrolet
OPEL
Oldsmobile
Cadillac
GMC
ASTRO 95
PONTIAC
TEREX
VEGA
BY CHEVROLET
HARRISON
FILL & COLD
GMC

Highlights

	1973	1972
Sales of all Products		
United States Operations		
Automotive products	$28,116,617,000	$23,894,834,000
Nonautomotive products	1,938,748,000	1,705,176,000
Defense and space	316,427,000	321,907,000
Total United States Operations	30,371,792,000	25,921,917,000
Canadian Operations	3,115,972,000	2,489,082,000
Overseas Operations	5,779,041,000	4,741,467,000
Elimination of Intercompany Sales	(3,468,516,000)	(2,717,235,000)
Total	$35,798,289,000	$30,435,231,000
Factory Sales of Cars and Trucks		
Manufactured in U.S. plants	6,512,000	5,741,000
Manufactured in Canadian plants	580,000	459,000
Manufactured in Overseas plants	1,592,000	1,591,000
Total	8,684,000	7,791,000
Net Income		
Total	$ 2,398,103,000	$ 2,162,807,000
As a percent of sales	6.7%	7.1%
Earned per share of common stock	$8.34	$7.51
Dividends per share of common stock	$5.25	$4.45
Taxes		
United States, foreign and other income taxes	$ 2,115,000,000	$ 2,059,800,000
Other taxes	1,090,700,000	917,900,000
Total	$ 3,205,700,000	$ 2,977,700,000
Investment as of December 31		
Working capital	$ 6,196,851,000	$ 5,564,775,000
Stockholders' equity	$12,566,777,000	$11,682,879,000
Worldwide Employment		
Average number of employes	811,000	760,000
Total payrolls	$10,308,510,000	$ 8,668,224,000

What Happened to the Revenue GM Received During 1973



Cover

GM cars, trucks, coaches, locomotives—movers of goods and people.

Contents

The Annual Stockholders' Meeting

will be held on May 24, 1974, in Detroit, Michigan.

It is expected that proxy material will be sent to stockholders beginning about April 18, 1974, at which time proxies for use at this meeting will be requested.

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Stock Transfer Offices

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New York, New York 10022

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Chicago, Illinois 60690

220 W. Congress Street
Detroit, Michigan 48226

21 King Street, E.
Toronto 1, Ontario

1350 Sherbrooke Street, W.
Montreal 25, Quebec

Letter to Stockholders

Richard C. Gerstenberg

Edward N. Cole

The year 1973 brought home again the swiftness of change and the impact of world events upon our company. General Motors in 1973 achieved record worldwide sales for the third year in a row and posted the highest earnings in its history. Yet the close of the year was shadowed by concern over the international oil shortage and widespread economic uncertainty. As a result, car buyers hesitated, sales slipped, and inventories piled up. General Motors and other manufacturers were forced to trim production and lay off workers. The year ended on a down note which obscured its distinction as the most successful in General Motors history.

The impact of the energy shortage on car sales was immediate and measurable. The customer's mood changed, almost overnight. Confidence gave way to concern and uncertainty about the availability of fuel. Worry about gasoline scarcities led many potential car buyers to defer their purchases, while others switched toward smaller cars.

In response, we are stepping up production of our Chevrolet Vega and compact models, working to improve gasoline mileage, and increasing our marketing efforts for full-size cars. Vega production has been increased by 50% since the car's introduction in 1970. Production of GM's compacts—the Chevrolet Nova, Pontiac Ventura, Oldsmobile Omega, and Buick Apollo—has been more than doubled over the same period. We are scheduling further expansion of small-car capacity for this summer. Vegas will be built for the first time on the West Coast, and our plant in Tarrytown, New York, will shift from assembly of full-size cars to compact Novas, Venturas, and Omegas.

Such adjustments in the mix of production involve more than the conversion of assembly plants. They require far-reaching changes in the scheduling and manufacture of components as well—and the average car contains about 15,000 parts. The production switch to smaller cars cannot be made as soon as we would like, principally because of the long lead time required for tooling and manufacturing major components.

Even as we tailor production to changing public preference, we remain aware that car-buying decisions are based on many factors, of which fuel economy is only one. Many families, concerned about fuel supply, will want smaller cars; but the family of five or six will find scant satisfaction in a four-passenger car, however many miles it gets to a gallon. The six-passenger, full-size car became the backbone of the market because it provides the transportation the typical American family needs for shopping and local pleasure trips, as well as the size and comfort for longer trips and vacations. For many people, the space, safety, and convenience of a full-size car will remain overriding considerations, although gas mileage has taken on added importance. Accordingly, our engineers are improving the fuel economy of all sizes of GM cars—small, intermediate, and full—and the results of their work are evident in the cars we are building this year.

Our forward product program had already anticipated a growing demand for smaller cars as well as full-size cars with improved fuel economy. Now this program is being stepped up to provide smaller and more fuel-efficient cars all the sooner. A few years ago, the public valued small cars as only basic transportation; now customers are looking for the same luxury and convenience in a small car that are usually associated only with full-size cars. The future GM cars, now being designed and developed, are attuned to this shift in the public's preference, and we intend to take full advantage of the new sales opportunity it presents.

The financial results for 1973, while they hit new highs, were again dominated by the now-familiar squeeze of profits between rising costs and controlled prices. While record sales lifted income to new levels, costs rose even faster and the margin of profit to sales shrank to 6.7%. Employment and payrolls were the highest ever. Dividends equaled the all-time record.

Two events occurred in December which will influence the future financial results of General Motors.

The first was the announcement by the Cost of Living Council that the prices of automobiles, trucks, and buses manufactured by the four major automobile companies were exempt from controls. The Council granted GM's pending request for an immediate price increase which had been more than justified by cost increases. The lifting of controls, however, was conditioned on a pledge to limit immediate price increases and to forego further price increases, except for major unforeseen circumstances, for the remainder of the 1974 model year. So, while GM must continue to absorb substantial cost increases, we are now able to look forward to a return to traditional marketplace competition, unfettered by artificial price controls, for the first time in two and one-half years.

The second event was the negotiation of new three-year agreements between GM and the United Automobile Workers, covering over 400,000 hourly employes in the United States and Canada. With a few exceptions, the GM settlement paralleled those which the union had reached earlier in the fall with our American competitors.

The object of negotiation is agreement; this agreement, however, is a costly one, and we cannot express unqualified satisfaction with its terms. We are pleased that a strike

was avoided. A strike, such as we endured in 1970, would have been greatly disruptive to our employes and their families, as well as to our industry and even the national economy. This was a lesson relearned in 1970, and neither we nor the UAW forgot it in 1973.

We are also pleased that our individual employes have improved their position among the highest paid industrial workers in the world. We have often acknowledged that the success of our Corporation is rooted in the quality of our employes. We also recall with satisfaction that the negotiations were conducted in a spirit of cooperation and without bitterness and rancor. Furthermore, there was some recognition by the union of the necessity to reduce absenteeism and improve productivity.

These are all pluses, to be sure. But candor insists that we report to our stockholders that these gains carried a high cost which should neither be underestimated nor concealed in post-settlement platitude. Indeed, the entire nation would benefit from a more objective recognition of the increasing burden of labor costs in our competitive industry, particularly those related to benefit plans. At General Motors, we are striving for greater efficiencies and intensifying every effort to avail ourselves of our sales opportunities in dealing with these higher costs.

Late in the year, as the energy shortage was thrust to the forefront of public attention, we stepped up our efforts to encourage our employes to conserve energy in the plants, in their homes, and on the road. Booklets were also distributed to our customers through our dealers detailing methods to improve fuel economy. Conservation is an excellent, if not essential, national policy for the short term—and we aim to reduce GM's energy use by 20% this winter—but the long-term solution requires expansion of the supply of energy as well as the more efficient use of what is already available.

For its part, General Motors is developing an environmentally sound process for the burning of coal, the nation's most abundant fuel. This month, we fired up our sulfur-dioxide scrubber system in our Chevrolet plant near Cleveland, which we expect will remove most of the sulfur dioxide that is formed when coal is burned. We are making this technology freely available to other companies. If this new system proves out, it will contribute to the wise use of natural resources in our coal-rich and environmentally concerned society.

Our confidence in the future of the automobile industry is unshaken. Fundamental economic strengths, such as the impending and inevitable upsurge in the age 25 to 44 population, provide a solid base for optimism. The long-term growth trend is upward, and we intend to contribute to this growth. During 1973, General Motors spent nearly $1.2 billion to expand and modernize our facilities throughout the world. In 1974, we will continue to invest substantial amounts to prepare for the higher production years that we see ahead. This year will be the sixth consecutive year in which capital spending will approximate or exceed $1 billion and may top the record of $1.3 billion set in 1965. We are building or enlarging several component and assembly plants in the United States.

Overseas, where the long-term potential for growth is even greater, we are also expanding significantly. In Germany, an extensive modernization and expansion at Adam Opel AG is about 25% completed. Vauxhall in England has begun major programs to add a new line of trucks larger than any present Bedford models, and to expand the Vauxhall passenger car line. In Brazil, major expenditures are being allocated to expand vehicle capacity, construct a new proving ground, and begin the manufacture of diesel engines. GM TEREX do Brasil's new manufacturing facilities are nearly completed, as are an assembly plant in Zaire and a new transmission plant in the Philippines. In Singapore, a parts distribution center to serve the Asia-Pacific area is now operational. General Motors Korea Company, Limited, a 50%-owned joint venture, completed renovation and reconstruction of a metal-casting plant during 1973 and is now producing engine components.

During 1973, we continued to advance in controlling auto emissions. The 1975 interim emissions standards, which will substantially remove the automobile as a source of air pollution, will be met with the GM catalytic converter on most of the 1975 cars we will introduce this fall. The converter system, which also permits significant improvements in gasoline mileage, is a major technological development in which GM's engineers can take a justified pride.

GM also maintained its progress in other areas of public concern. We became the first manufacturer to market the new air cushion restraint system, an important advance in automotive safety. We made substantial reductions in air, water, and noise pollution from our manufacturing facilities. We provided our employes with more healthful and safer working environments, and we expanded the hiring, training, and advancement of women and minority employes.

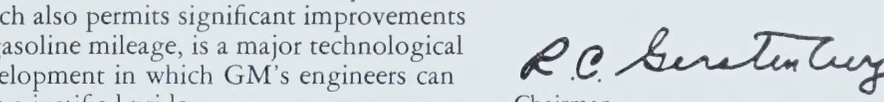
The energy shortage is having other, more positive, consequences. It is drawing attention to the national need for better and more balanced urban transportation. In January 1974, GM, the leading manufacturer of coaches and locomotives as well as cars and trucks, established the GM Transportation Systems Division. The new Division, charged with coordinating, intensifying, and enlarging our activities in urban and public transportation, will make us better able to apply our considerable resources to meet this national need and substantial future sales opportunities.

The duration and extent of the energy shortage and the resultant consumer uncertainty are still unclear. Nevertheless, we estimate that vehicle sales for the industry in the United States this year will be in the area of 13 million units, including imports, or about 11% below 1973. This would break down to about 10 million cars and 3 million trucks. Such volume would indicate a good year for our industry by most past standards and would be above sales in any year before 1972.

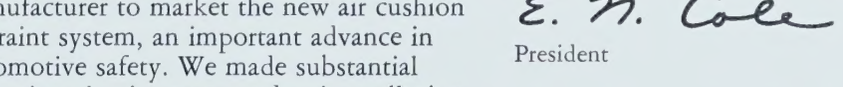
The times are again testing GM's ability to respond to new and changing market opportunities. The economic situation asks much of GM management and of the skills, imagination, and dedication of our employes. We are always mindful that the success General Motors enjoys today has been earned by its response in other times to the needs and desires of our customers. GM in 1974 has the resources to do what must be done, and in so doing, to protect and enhance the interest of our employes, our customers, and you, the owners of the business.

The outstanding records achieved by General Motors in 1973 could not have been accomplished without your continued support, along with the dedication and cooperation of our employes, our dealers and suppliers, and the sustained loyalty of our customers. These underlying strengths of General Motors allow for nothing but optimism about the future of our company.

This report is prepared and submitted to the stockholders of General Motors by order of the Board of Directors.

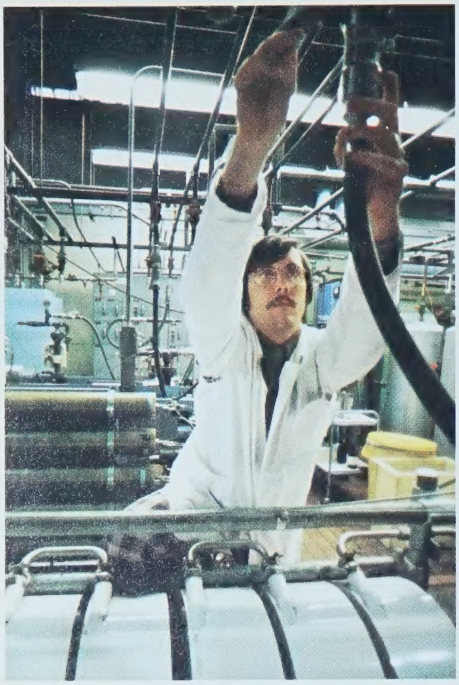


Chairman



President

February 13, 1974



Development work continued on GM's Total Water Conservation System, the goal of which is to process industrial waste water for reuse, and reclaim materials in solution, if possible.

Pontiac Motor Division's final assembly line (below) and paint drying oven (right).

The Year in Review

Retail sales of cars and trucks in calendar year 1973 were the highest ever in the history of the United States automobile industry, despite a sharp decrease in sales during the fourth quarter when consumer concern over the energy shortage had a sudden and dramatic impact on the automobile market. General Motors participated in the success of the industry by setting new sales records for the third straight year and achieving the highest earnings in its history.

A number of economic factors combined to produce the excellent sales results recorded. In the United States, industrial output, employment, and income rose rapidly during most of the year. Consumers' real income increased despite persistent inflationary pressure. Business expenditures to modernize and expand capacity registered a substantial gain, and exports of American-produced goods—following the currency realignment of the previous two years—rose sharply.

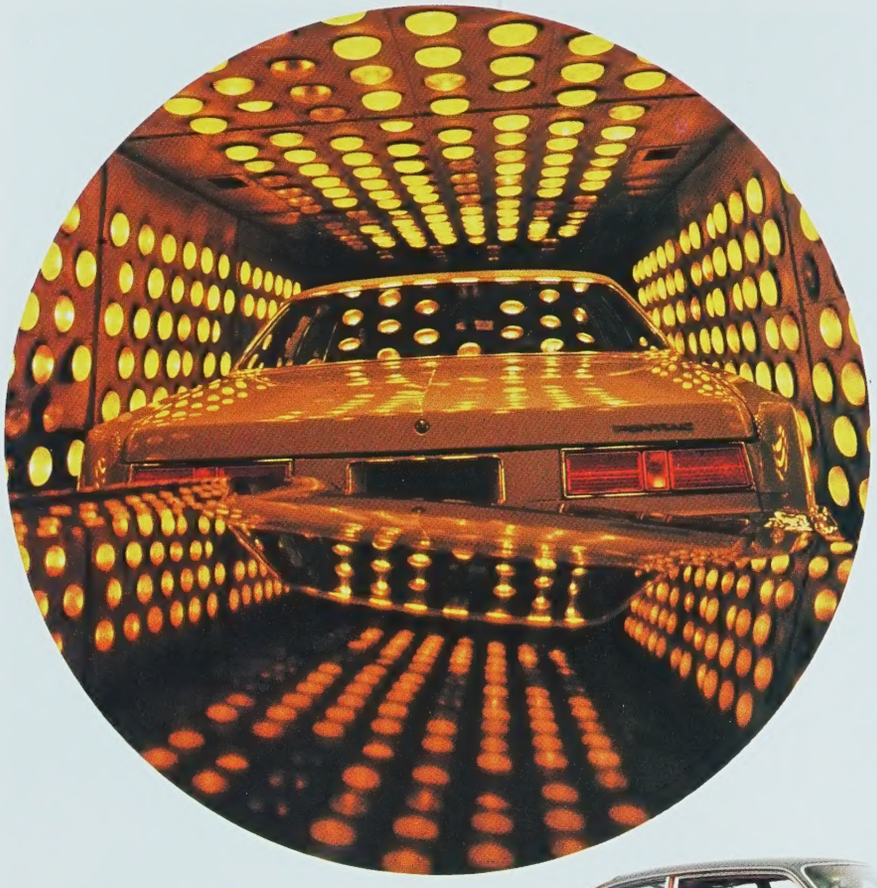
Retail sales of cars and trucks in the U.S., including imports, totaled 14.6 million units, an increase of 7.5% over the 1972 record. Car sales were a record 11.4 million units, 4.5% above 1972, and truck sales totaled 3.2 million units, a substantial 20% gain over the prior record in 1972. Industry sales were also a record in Canada and overseas.

The industry's impressive sales figures for the calendar year were based on the strength of sales during the first three quarters. The decrease in sales in the final quarter, caused mainly by the widespread public uncertainty over the energy situation, had an adverse effect on sales of 1974 models, and it was necessary to reduce and adjust production schedules at the end of the year to meet changing consumer demands.

The closeout of the year saw an increased consumer preference for smaller cars. GM, with its many years of worldwide experience in building small cars, had already taken steps during the year to increase small car production. The Corporation entered 1974 with facility modifications under way to increase small car output to meet the demands of the marketplace.

GM's U.S. Automotive Sales

GM's 1973 factory sales of cars and trucks in the United States totaled a record 6,512,000 units—5,251,000 cars and 1,261,000 trucks. These total sales represented a 13.4% increase over the 5,741,000 units sold in 1972 and 12.9% over 1971, the previous record year.



Human factors engineering is applied to the design of a car's interior in order to accommodate the broadest possible range of human physical characteristics.

Opel Diplomat 4-Door Sedan.

Chevrolet Vega Hatchback GT Coupe.

Individual retail sales records were set by Chevrolet, Oldsmobile, Cadillac, and GMC Truck & Coach. Chevrolet sold more than 3 million cars and trucks for the third consecutive year, and exceeded one million truck sales for the first time in its history, making it the leading producer and seller of trucks as well as passenger cars in the United States. GMC coach sales were up over 1972, and it is expected that they will remain at high levels as increasing emphasis is placed on public transportation.

Of all new cars sold in the United States during 1973, including imports, 45.0% were GM products, slightly above 1972. Truck production was at a maximum throughout the year to meet the demand for trucks of all sizes, especially those used for recreational purposes. Including imports, 40.3% of all trucks sold in 1973 were GM models, as against 38.8% in 1972.

GM of Canada

General Motors of Canada Limited had record factory sales of 580,000 vehicles in 1973. This compared with 459,000 units in 1972 and 509,000 units in 1971—the previous record year. In 1973, GM of Canada sold 211,000 vehicles imported from GM plants outside of Canada and exported 299,000 vehicles built in Canada for sale in the United States. Of the units produced domestically and imported from the U.S., 24,000 units were exported to countries outside North America. Sales for the year by GM of Canada, expressed in U.S. dollars, totaled a record $3.1 billion, 25% above the previous record of $2.5 billion set in 1972.

Both production and employment at the Ste. Therese, Quebec, assembly plant, which was converted from full-size car production to Vega production at the start of the 1973 model year, increased substantially during the year when a second shift was added. Production was increased by another 40% in early 1974. The Ste. Therese plant also builds the Pontiac Astre, a subcompact car introduced in January of 1973 and sold in Canada by Pontiac-Buick dealers.

General Motors Overseas

In 1973, General Motors established a new record for dollar sales outside the United States and Canada. Total sales of all products overseas, including sales to U.S. and Canadian operations, amounted to $5.8 billion in 1973, a 22% increase over the previous record of $4.7 billion established in 1972.

Factory sales of 1,592,000 passenger cars and trucks produced overseas, together with sales of 86,000 exports from the United States and Canada, totaled a record 1,678,000 units, compared with the previous 1972 record sales of 1,672,000 units. The factory sales included 43,000 light trucks manufactured by Isuzu Motors Limited in Japan and marketed by GM Overseas outside North America and by Chevrolet in the U.S.

Net income attributable to overseas operations amounted to $216 million in 1973, compared with $169 million in 1972, and was 9% of GM's total net income for the year, compared with 8% in 1972.

In 1973, General Motors operations outside the U.S. made a favorable contribution of $750 million to the U.S. balance of payments. GM's favorable contributions to the balance of payments since the end of World War II now total $14.8 billion.

In the Federal Republic of Germany, factory sales of Adam Opel AG totaled 845,000 vehicles in 1973, compared with the record 904,000 units sold in 1972. Factors responsible for the decrease included German mark

revaluations, which caused Opel prices to increase in many countries, and anti-inflation measures taken by the German Government which affected domestic sales. Opel, however, remained the best selling car in Germany for the second consecutive year. During 1973, 52% of total Opel production, or 439,000 units, was for export.

In England, factory sales of Vauxhall cars and Bedford trucks totaled 259,000 units in 1973, compared with 273,000 vehicles sold in 1972. Work stoppages at Vauxhall Motors Limited and supplier firms—including a gas industry dispute which caused a four-week stoppage of manufactured gas supplies—severely restricted production, particularly of passenger cars. In the fourth quarter of 1973, sales were affected by the severe energy shortage which, in late December, caused the institution of a three-day workweek. Despite these problems, Vauxhall still increased its production and exports of Bedford vans and trucks and again exported more trucks than any other British manufacturer. During 1973, 44% of Vauxhall's total van and truck production of 107,000 units was for export.

In Australia, the motor vehicle market increased sharply during 1973 after several years of relative stability. General Motors-Holden's Pty. Limited had total factory sales of 200,000 units in 1973, a new record, compared with factory sales of 189,000 vehicles in 1972. Although production was limited by labor and material shortages, GM-Holden's accounted for 30.3% of the new vehicles sold in Australia in 1973 and retained its position as sales leader for the 21st consecutive year.

In Latin America, factory sales by General Motors do Brasil S.A. set a new record of 143,000 units in 1973, a 40% increase over the 1972 record of 102,000 units. The Chevette, a new small-size car introduced in April, was well received by Brazilian customers while the Opala continued as Brazil's leading mid-size car. GM was the leading manufacturer of trucks in Brazil, with sales of 52,000 units. Factory sales by General Motors Argentina S.A. amounted to 30,000 vehicles in 1973, compared with 28,000 units in 1972. In Mexico, factory sales of General Motors de Mexico, S.A. de C.V. totaled a record 35,000 vehicles, compared with the previous record of 32,000 units in 1972.

General Motors South African (Pty.) Limited had record factory sales of 37,000 units in 1973, up 63% over the 23,000 vehicles sold in 1972 and 29% above the previous record of 29,000 units set in 1970.

Production and marketing of GM's Basic Transportation Vehicle, designed to provide low-cost, dependable transportation, is now under way in six countries—Ecuador, Malaysia, the Philippines, Portugal, Costa Rica, and Surinam. The list of countries where it is offered is expected to grow.

In Iran, the agreement with the Pahlavi Foundation and the SS Jeep Company, announced by GM in June 1972, was concluded in April 1973 with the formation of General Motors Iran Limited. This joint venture company, in which GM has a 45% interest, will assemble and distribute General Motors passenger cars in Iran. GM is also engaged in studies, discussions, and negotiations in other overseas areas which could result in additional new operations.

General Motors has always followed the practice of seeking to hire, train, and promote local citizens in the countries in which it operates. Of the 193,000 employes of General Motors Overseas Operations, only some 440 are assigned as International Service Personnel. Of these, approximately 360 are assigned from the U.S. and 80 from other countries.

1974 model Vegas at the GMAD Lordstown, Ohio, assembly plant ready for shipment to Chevrolet dealers.

One method of shipping Vegas is by the Vert-A-Pac railroad car, which can carry 30 Vegas standing on end.

A chemist checks paint samples at GM Manufacturing Development.

Coach assembly line, GMC Truck & Coach Division.

In July 1973, a new automotive components organization was established within GM Overseas to plan and coordinate the engineering, manufacture, and sale of components. The organization's functions include: assisting General Motors U.S. components divisions in their export programs; working toward increased use of GM components in overseas products; and coordinating participation in international complementation programs. Complementation provides for components manufacture and vehicle assembly in several countries of a region, with each country having a specialized components production responsibility for the entire region.

Sales of Nonautomotive Products

In 1973, General Motors had record sales of commercial nonautomotive products in the United States totaling $1.9 billion, or 14% above the 1972 level.

For the third consecutive year, Electro-Motive Division had record dollar sales. U.S. deliveries included 40 high-speed, 3,000-horsepower passenger locomotives to Amtrak, with 110 similar units to be delivered in 1974. The Division has also received a contract for the initial complement of locomotives for the North and Northwest Suburban Mass Transit Districts in Chicago.

Export deliveries of locomotives during 1973 were up 19%. To meet increased worldwide demand for diesel locomotives, General Motors Overseas Operations, in cooperation with Electro-Motive, is currently establishing manufacturing facilities in South Africa. A new company, GM Locomotivas Ltda., was established in Brazil during 1973 to arrange for locomotive manufacture. General Motors also has locomotive licensees in Argentina, Australia, Mexico, Spain, Sweden, and Yugoslavia.

Record sales by Electro-Motive of high horsepower diesel engines and power systems in other markets were also set, especially in marine and oil well drilling rigs, with the latter showing strong growth over the past few years as oil-consuming nations seek new sources of supply.

Frigidaire Division made important progress in 1973 in its major household appliance and automotive air conditioning component operations. As a leader in the major appliance industry, Frigidaire continued to make significant design improvements. A revolutionary new 30-inch Touch-N-Cook electric range, which brings computer technology into the kitchen for the first time, was introduced. This same type of design has been incorporated into a built-in wall oven and countertop cooking unit introduced in January 1974. Another new Frigidaire product, introduced in 1973, is the "Conversation Piece" refrigerator, which incorporates a complete message center—radio, tape recorder, and tape player—into the freezer door of a three-door Custom Imperial refrigerator.

GM's TEREX Division, which manufactures earthmoving crawler tractors, scrapers, front-end loaders, and haulers, achieved sales increases in all phases of its business. The Division's new line of off-highway haulers has been well received by customers. Early in 1974, a new generation of crawler tractors will be introduced, ranging from 180 to 370 horsepower, that will offer many new design features and provide customers with a product that can be used in all light, medium, and heavy-duty applications.

For the second consecutive year, Detroit Diesel Allison Division had record sales for its heavy-duty diesel engines and established record sales for its transmissions. A new diesel engine series was added to the three series of

Highly skilled craftsmen at Fisher Body play an important role in making the wood models from which steel metal-forming dies are made.

Particulate sampler designed to study emission of microscopic particles in automotive exhaust, GM Research Laboratories.

Experimental integrated circuits on silicon wafers (edge view) during furnace diffusion, GM Research.

Buick Regal Colonnade Hardtop Coupe.

engines being produced for truck, marine, and industrial use. The new series will provide 25% more horsepower within the same physical dimensions of existing engines.

The Division produced its 500,000th commercial transmission during the year and developed the first fully automatic transmission in the U.S. for off-highway vehicles. Also, Detroit Diesel Allison received an $87 million contract for military vehicle engineering and a $32 million contract for the design and development of a turboshaft engine for the U.S. Army's new prototype heavy-lift helicopter. The new engine will produce 8,000 shaft horsepower, making it the most powerful turboshaft engine in the Free World. The Division also announced the construction of a new plant in Romulus, Michigan, that will increase diesel engine production by almost 25%.

Automotive Safety

Air cushions, bumpers, and belt restraint systems received major attention by General Motors in its continuing program to improve the operational safety of its vehicles and provide increased occupant protection. In 1973, GM expenditures for automotive safety in the United States totaled $653 million for research and engineering development, reliability, testing, facilities, and tools. In 1972, expenditures for automotive safety were $507 million.

A significant safety-related development occurred on November 29, 1973. On this date, General Motors successfully completed a five-year developmental program when the first car equipped with an air cushion restraint system as a production option—an Oldsmobile Toronado—rolled off the assembly line. General Motors now has the only production cars on the road that meet the National Highway Traffic Safety Administration's requirements for a fully passive, front seat restraint system. The air cushion restraint system is available as an option on most full-size Oldsmobile, Buick, and Cadillac models. The system provides restraint for the driver and front seat passengers and includes lap belts for all seat positions.

All 1974 model GM cars now have energy-absorbing front and rear bumpers that meet Federal standards calling for 5-mile-per-hour barrier impact protection to safety-related components.

To encourage greater usage of seat belts, the Government established safety standards for 1974 and 1975 model cars. The standards require the restraint system to be designed so that the engine cannot be started unless the driver and right front seat passenger (if any) have fastened their combination lap and shoulder belts. GM's starter-interlock restraint system for 1974 is designed to encourage regular use of the proven life-saving abilities of restraint systems and includes features which make the lap and shoulder belt combination easy to use and comfortable to wear.

Automotive Emissions Control

Work on automotive emissions control during 1973 involved the equivalent of more than 4,800 full-time scientists, engineers, technicians, and supporting personnel, plus the expenditure of some $310 million for research and engineering development, testing, tools, and facilities. Expenditures for automotive emissions control work in 1972 totaled $238 million.

Included in GM's emissions control work was the final development and refinement of control systems to meet the two sets of 1975 interim standards—one for California, the other for the rest of the nation—established in April 1973 by the Environmental Protection

Diesel engines ready for shipment at Detroit Diesel Allison Division.

Computer technology entered the kitchen with Frigidaire's revolutionary Touch-N-Cook electric range.

Agency (EPA). The nationwide interim standards require that 1975 model cars emit, per mile, not more than 1.5 grams of hydrocarbons, 15 grams of carbon monoxide, and 3.1 grams of nitrogen oxides. For California, the standards are 0.9 gram, 9 grams, and 2.0 grams, respectively. These would reduce emissions from the levels of uncontrolled cars of a decade ago by 90% for hydrocarbons, 83% for carbon monoxide, and 38% for oxides of nitrogen, with higher reductions for California.

GM will meet the 1975 interim standards by using a catalytic converter on most of its cars. This decision was made in the belief that it is the best choice of available alternatives when viewed from the standpoint of time available to meet the 1975 standards, in addition to providing improved emissions control, durability, maintenance, driveability, and least total cost to the consumer over the vehicle's life. Field tests are currently being conducted in different parts of the country to test the durability of the catalytic converter system under various kinds of high mileage operations, such as taxicab use.

A major advantage of using the converter on 1975 models will be the significant improvement in fuel economy compared to 1974 models. This is possible because the converter treats the exhaust gases after combustion and allows an engine to be tuned to provide the multiple benefits of improved driveability and improved fuel economy. AC Spark Plug Division will produce the catalytic converter at its Oak Creek, Wisconsin, facility.

During the 1973 Congressional session, both the House and Senate passed bills to extend the 1975 interim standards—the Senate for one year and the House for two years. However, the two bodies were unable to resolve their differences on other issues in the same bill, and Congress recessed in December without resolving the issue.

Uncertainty continues to exist as to what the 1976 standards will be and this results in little time being left in which to complete emission certification testing in time for the start of 1976 model production.

Still to be resolved is one of the most difficult aspects of the 1970 Amendments to the Clean Air Act—the standard for oxides of nitrogen currently scheduled to be effective with 1977 model cars. This standard calls for a nationwide lowering of the 1976 standard for nitrogen oxide emissions from 2.0 grams per mile to 0.4 gram.

The EPA has recommended to Congress that the oxides of nitrogen standard be modified to a more realistic level. There is general agreement that the nitrogen oxides standard was based on faulty data and that no health risk would be associated with relaxing the standard to a more reasonable and attainable level. Congress has still to act on this recommendation. Meeting the 0.4 gram per mile standard for oxides of nitrogen, in combination with existing and original standards for hydrocarbons and carbon monoxide, is beyond current mass production technology.

Alternate Power Plants

While work proceeded on improving existing power plants, investigations continued during 1973 to explore alternate power plants. Since 1963, General Motors has evaluated over 350 alternate power plant proposals, with some of the more promising concepts being developed into experimental working engines for further research and development. Of the $310 million spent on emissions control in 1973, $53 million related to the development of alternate power plants, compared with $36 million in 1972.

Increased emphasis was placed on the

TEREX off-highway hauler.

The metric system is now being applied to all new GM products under development.

evaluation of the jet-ignition stratified charge engine concept, with indications being that the engine may be applicable to future vehicles. Emissions control for low levels of oxides of nitrogen and some driveability characteristics are problems and development continues.

Studies also continued on the gas turbine engine, which is near commercial application on GM coaches and trucks. In applying the gas turbine to passenger cars, however, problems still remain in the areas of fuel economy, acceleration, and high production cost. A recent development by the GM Research Laboratories of a less expensive method for manufacturing stainless steel foil used in the heat-exchanger portion of the turbine engine has a cost savings potential.

Diesel engines for U.S. passenger car use also continue to be studied and tested, with the control of particulate emissions, odor, and noise as major technical problems. A diesel-powered Opel, introduced in the fall of 1972 for sale in Germany, is providing experience in performance and customer acceptance.

With respect to the rotary combustion engine, development work continues on improving emission levels and fuel economy. The rotary engine, which provides the desirable characteristics of small size, low weight, fewer parts, and exceptionally smooth operation, will be made available as an option as soon as it is deemed ready for mass production, probably during the 1975 model year. In December 1973, General Motors paid its fourth installment under its worldwide Wankel rotary combustion engine license agreement with Curtiss-Wright, Audi-NSU, and Wankel G.m.b.H.

Fuel Economy Improvements

Major emphasis is being directed toward improving the fuel economy of GM cars and trucks. Gasoline consumption has been increased in recent years as a result of meeting Government-mandated cleaner air requirements. Emissions control hardware has had a detrimental effect on engine efficiency and fuel economy. This trend will be reversed with 1975 models, however, when improved fuel economy will result from the use of catalytic converters. Programs are under way to improve fuel economy through engine redesign and other power train modifications.

Meeting the safety standards has added weight to vehicles, with a resulting increase in gasoline consumption. Since the weight of a vehicle is an important factor in the amount of fuel it uses, GM has instituted an intensive program to reduce vehicular weight through the increased use of plastics and aluminum.

For example, GM continues with work on its experimental, light-weight "soft-face" plastic bumper, made of a plastic cushioning material covered by a tough but flexible plastic exterior facing. A two-year test program, involving 100 New York City taxis fitted with the plastic front and rear bumpers, is evaluating the aging and durability characteristics of the soft-face plastics and comparing the impact protection characteristics and repair costs of the material with steel bumpers. GM also is experimenting with plastic fenders and hoods.

More attention also is being given to improving the aerodynamic efficiency of vehicles. A new aerodynamic laboratory to be built at the GM Technical Center for testing full-scale models will play an important part in this phase of the program. Efforts also are being directed toward reducing friction losses in bearings, in transmissions, in accessories—and in tires. One example of what can be achieved is the GM-designed steel-belted radial ply tire, introduced with 1974 models. This tire improves fuel economy up to 5%

Vauxhall water test at Millbrook Proving Ground, England.

Engine assembly, Detroit Diesel Allison Division.

Evaluating catalytic materials, GM Research.

Cadillac Sedan De Ville Hardtop Sedan.

compared with previously used original equipment tires by reducing the rolling resistance between the tire and roadway.

GM and Energy Conservation

Energy conservation has always been an important management objective in General Motors, primarily because of its cost saving possibilities. The Mid East oil embargo, however, and the associated shortage of available energy supplies resulted in GM accelerating its response to the immediate and long-range implications arising from the changing patterns of energy demand and supply projections.

In February 1973, the importance of efficient energy usage was reemphasized with the establishment of new corporate-wide programs for managing, monitoring, measuring, and reporting progress in energy conservation. A goal of a 10% annual reduction in energy usage in GM plants was established. In November, the goal was increased to 20% during the winter months, when energy use is high.

Short-term measures to conserve energy, of course, will not provide a complete solution to the energy problem. Prompt action is needed to develop the nation's enormous energy resources. One such resource is coal. The U.S. has nearly one-half of the world's known coal reserves, but its high sulfur content makes much of it environmentally unacceptable. However, GM's innovative sulfur-dioxide scrubber system, fired up in February 1974 at the Chevrolet-Parma, Ohio, plant, is expected to remove over 90% of the sulfur oxides from coal burning when fully operational. This is equivalent to burning coal with the lowest sulfur content available. GM's scrubber system, under development since 1968, has long-term implications, as it is expected to allow the greater use of coal and the conservation of scarce fuels.

Research Activities

The General Motors Research Laboratories in 1973 completed the second year of its expansion program that will increase its staff and facilities approximately 50%. Much of the expansion will come in the environmental sciences, biomedical research, the behavioral sciences, physical chemistry, and transportation and urban planning, with increased emphasis being placed on long-range applied research and the socio-economic dimensions of technical problems.

In 1973, GM spent $1,018 million for research, product engineering, and development activities related primarily to the development of new products or services or the improvement of existing products or services, including activities related to vehicle emissions control and the safety of persons using GM products. In 1972, this totaled $880 million.

Public Transportation

Cars and trucks are the backbone of American transportation and will continue to be in the foreseeable future. However, they are not the only—and sometimes, not even the best—means of transportation. The growing need for expanded public transportation systems has been recognized in recent years, and pressures for more diversified, balanced transit systems are now widely evident in the United States and in other countries. GM, as a leader in providing the public with the transportation it wants, is responding to the public transit needs, in whatever form they take, with the GM Transportation Systems Division, established in January 1974. This new Division will coordinate, intensify, and enlarge upon GM's existing activities in

1973 marked the 20th anniversary of the founding of GM's Training Centers.

Holden 4-Door Sedan on test track at GMH Lang Lang Proving Ground, Australia.

public transportation. It will bring together specialized talents of the Research Laboratories and the Engineering Staff and will work closely with the GMC Truck & Coach and Electro-Motive Divisions. In this way, the full resources of GM will be used to help meet the overall transportation needs of the U.S. and other countries.

The personnel from the Research Laboratories and Engineering Staff will provide extensive experience in public transportation research projects. For example, GM's pioneering work in studies of single and multiple-lane traffic flow was instrumental in helping establish the "exclusive bus lane" concept now being used in a number of cities for public transit. GM's "METRIP" concept improves downtown bus service by organizing buses into platoons and providing waiting passengers advance information on bus arrivals. GM Research Laboratories developed the computerized technique called MATCH for classifying metropolitan areas by their transportation-related characteristics. Another example is the Dual Mode Transit System concept—presently under study—in which a driver-operated bus picks up riders in suburban neighborhoods, then proceeds to an automatically controlled guideway for delivery of the passengers to major interchanges.

To help meet the near-term needs of public transportation, GMC Truck & Coach Division is currently spending more than $32 million for tooling and equipment to produce a new line of coaches to be introduced in 1976. These coaches will provide increased passenger comfort and incorporate significant manufacturing advances. The coaches will be powered initially by GM diesel engines, but also will be capable of being powered by GM's new gas turbine engines, now undergoing final testing. For those cities which can utilize rail transportation in their public transit systems, Electro-Motive Division recently completed the design and development of a new locomotive for commuter service.

Materials Conservation, Solid Waste Management

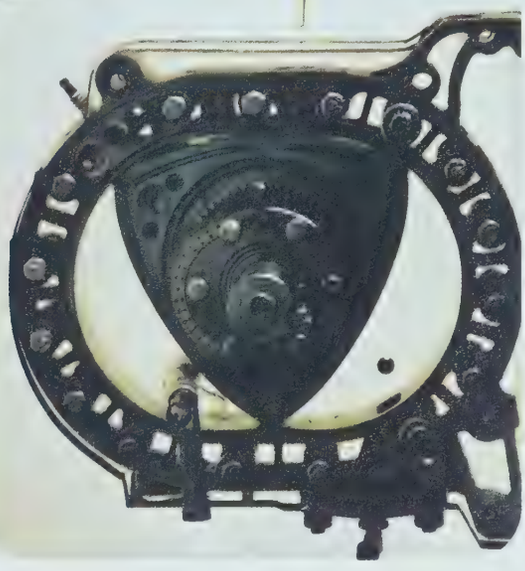
GM's continuing program of materials conservation and solid waste recovery is receiving greater emphasis as the availability of many materials is decreased and costs of materials increase. Throughout the design and manufacture of GM products, specific guidelines are applied to conserve and reuse materials.

For example, GM uses over 12 million gallons of waste oils as boiler fuel each year, and over 120,000 tons of cardboard and other paper products are currently being recovered for reuse. GMC Truck & Coach and Buick Divisions will shortly put into operation new boilers that will burn a combined total of 76,000 tons per year of plant solid waste as supplemental boiler fuel. Oldsmobile Division each year sells about one million gallons of clarified oil, used in its manufacturing operations, to a city-owned utility for electrical power generation. The MacroMesh system for recovering metal scrap, developed by the GM Research Laboratories, has been installed at Delco-Remy Division to convert steel machining chips from its operations into high-quality magnetic pole pieces for use in the starter motors it manufactures. The XtruCast Process, also a Research Laboratories development, is currently in use at Oldsmobile Division to convert scrap steel back into high-quality bar stock for forging into automotive parts.

Central Foundry Division's Danville, Illinois, plant has a unique program that

Left—Demand was high in 1973 for GM trucks—of all sizes. Below—Electro-Motive passenger locomotive for Amtrak service.

Left and Below—Development work continued on the rotary combustion engine to improve emission levels and fuel economy.



Pontiac Luxury LeMans Safari Station Wagon.

recycles over 3,000 automobile hulks per month, collected from the Danville and neighboring areas, into iron castings. Because of the highly efficient emission control units on the plant's cupolas, unburned junk car hulks can be cut, bundled, and used as low-cost melting stock without causing air pollution. The Danville program encourages scrap dealers who lack controlled-burning facilities or shredders to purchase and process abandoned and junk cars. This is one example of GM's program to assist communities in developing ways for removing junk cars from the countryside.

Industrial Air and Water Pollution Control

GM's commitment to clear the skies over its metal-casting plants by the end of 1973 has been met. The major visible emissions are now gone from GM's iron-melting facilities. Major installations during the year included new induction melting facilities, new electric arc melting furnaces, and the final installation on all remaining cupolas at General Motors metal-casting plants of either high-energy scrubbing systems or dust-collecting systems to assure that the discharge into the atmosphere is essentially free of particulates.

Plans are also going forward to reduce the emission of hydrocarbons into the atmosphere from painting operations at General Motors assembly plants by experimental powder painting techniques and pilot use of water soluble enamels, both of which significantly reduce hydrocarbon emissions.

With respect to water pollution control, the number of GM water treatment facilities now totals 117, with 37 new pollution control projects initiated in 1973 for GM plants in the U.S. and Canada. These projects include new waste treatment facilities, expansion of existing treatment facilities, and the building of storm water retention lagoons.

Work continues at the Technical Center on GM's Total Water Conservation System (TWCS) to attempt to achieve "zero discharge" of water pollutants—a Federal Government goal established for 1985. The object of TWCS is to process industrial waste water so it can be reused in the plant, with only a small amount of make-up water being required in the total system.

During 1973, GM's expenditures for air and water pollution control facilities totaled $69 million. This does not include the sizable expenditures made in the areas of research and development and operating costs. In 1972, expenditures were $58 million.

Noise Control

Under the Noise Control Act of 1972, the EPA now has responsibility for designating products which are major noise sources and for formulating noise control regulations during 1974. General Motors engineers have demonstrated vehicular noise control methods, and their cost implications, to some interested Government agencies for the purpose of furnishing information which can be used during the formulation of regulations.

GM's current model cars and trucks are designed to comply with applicable state and city noise-level standards—84 decibels for cars and 86 decibels for trucks. Environmental noise-measuring techniques are being refined further to obtain a better understanding of the impact of vehicular noise upon the community.

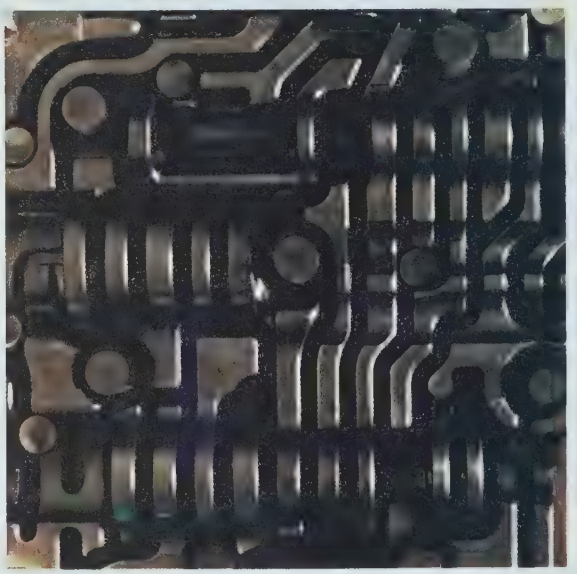
GM also is at work developing ways to control noise in and from its manufacturing plants. All plants have been surveyed for internal noise and controls initiated where needed. One development in controlling plant noise—the "General Motors Sound

Left—Engine test preparation, GM Desert Proving Ground, Mesa, Arizona.

Right—Pre-production evaluation of a disassembled El Camino pilot model, Chevrolet Engineering Center.

Below—A mold for an automatic transmission experimental plastic component.

The Chevette, GM do Brasil's new small-size car introduced in 1973.



Oldsmobile Regency Ninety-Eight Hardtop Coupe.

Level Specification for Machinery and Equipment"—is being used as the basis for the purchase of new, quiet machinery and equipment.

In-plant noise control is one part of a continuing program to meet the Federal Occupational Safety and Health Act (OSHA) and to improve employe working conditions. Meeting OSHA requirements covers a range of items from aisle marking lines to X-ray equipment. During 1973, GM spent $238 million to improve employe working conditions and to meet the provisions of OSHA at its U.S. plants. Most of these expenditures would have been made in the ordinary course of business without the OSHA regulations being in effect.

Litigation

In the spring of 1972, a two-count antitrust criminal indictment was filed in Detroit by the Justice Department charging General Motors and Ford with conspiracy in 1969-70 to fix prices and to monopolize the market for automobile fleet sales. General Motors maintained that the charges were without basis. After a lengthy trial, the court dismissed the monopoly charges, and the jury on December 19, 1973 acquitted General Motors and Ford of the conspiracy charges.

Proceedings in the Government's companion civil case are currently in progress before the Federal Court in Michigan.

In 1973, two favorable decisions were handed down resulting in the dismissal of 34 class actions filed against the major domestic automobile companies, including General Motors, and the Motor Vehicle Manufacturers Association. The suits, which were filed by various states, cities, counties, and individuals, alleged a conspiracy in violation of the antitrust laws to delay the development and installation of motor vehicle emission control devices, and sought treble damages and equitable relief.

In the first decision, the U.S. Court of Appeals for the Ninth Circuit dismissed the damage claims. Review was denied by the Supreme Court. Subsequently the Los Angeles Federal District Court dismissed the remaining claims.

Aid to Education

In 1973, GM's financial aid to education amounted to $6.4 million. This total included grants to colleges, universities and associations of colleges; individual fellowships; research and engineering grants to universities and technical institutions; support of special education projects; and the General Motors Scholarship Program, under which 704 college and university students are receiving financial assistance.

Community Activities

Worldwide, General Motors provided $10.2 million during 1973 in the continuation of its policy to make reasonable contributions to charitable, educational, and community organizations in localities where it operates, as well as to some large national organizations. Contributions, except in the case of education, are generally related to the size and employment of the Corporation's operations in a given community where GM employes and their families reside. On a national level, GM contributes to organizations in which, as a large industrial corporation, our participation would be appropriate.

During 1973, approximately 90% of GM's total contributions were in support of local organizations such as community funds, family service groups, hospitals, youth organizations, and minority-related groups in cities in which GM has operations. Many of these

Experimental plastic hood—one phase of GM's program to reduce vehicle weight.

GM expanded its line of recreational vehicles with the GMC Motor Home, introduced in February 1973.

organizations are working to create equal opportunity regardless of race and to provide employment and housing for disadvantaged people.

Board of Directors

During 1973, the following changes in the membership of the Board were announced:

One new member, Dr. Charles H. Townes, was elected to the Board. A University of California professor of physics since 1967, Dr. Townes received the Nobel Prize in 1964 for his role in the invention of the maser and laser. He had served as Chairman of GM's Science Advisory Committee.

Two members of the Board died during the year: Thomas L. Perkins, Counsel to the law firm of Perkins, Daniels & McCormack and Chairman of the Trustees of The Duke Endowment and a member of the Finance and Nominating Committees; and Charles Stewart Mott, Honorary Chairman, Board of Trustees and Treasurer, Charles Stewart Mott Foundation. Mr. Mott served the Board for a sixty-year period and during this time held posts on the Board's Finance, Executive, and Audit Committees. Both Mr. Mott and Mr. Perkins contributed generously to the deliberations of the Board and to the Committees on which they served.

Two non-employe directors retired after many years of valued service to GM: Lloyd D. Brace, former Chairman, The First National Bank of Boston; and J. Wesley McAfee, Chairman, Union Electric Company.

Harold G. Warner, GM Executive Vice President, also retired, having served the Board with distinction for six years.

The membership of the Board now totals 24, of whom six are officers of GM.

The Board announced a number of changes in committee assignments and committee memberships. Eugene N. Beesley was elected Chairman of the Bonus and Salary Committee, succeeding Mr. Brace, and Charles T. Fisher, III was elected Chairman of the Audit Committee, succeeding Mr. McAfee. John T. Connor was elected Chairman of the Nominating Committee, succeeding Mr. Beesley in that capacity. Mr. Beesley continues as a member of the Nominating Committee.

New committee memberships include the election of John A. Mayer and Stephen D. Bechtel, Jr. to the Finance Committee; the election of Howard J. Morgens and James M. Roche to the Bonus and Salary Committee; the election of Walter A. Fallon to the Audit Committee; the election of Catherine B. Cleary, Harry Heltzer, and Dr. Charles H. Townes to the Public Policy Committee; and the election of Stephen D. Bechtel, Jr. to the Nominating Committee. Mr. Bechtel will continue as a member of the Bonus and Salary Committee. In addition, John A. Mayer relinquished his assignment on the Audit Committee, but will continue as Chairman of the Public Policy Committee and as a member of the Nominating Committee.

Organization Changes

Harold G. Warner, Executive Vice President and Special Assistant to the President, and Louis H. Bridenstine, Vice President and Associate General Counsel, retired under the provisions of the GM Retirement Program.

Kenneth N. Scott, Vice President, and formerly Group Executive in charge of the Body and Assembly Divisions Group, was appointed Special Assistant to Richard L. Terrell, Executive Vice President in charge of the Car and Truck and Body and Assembly Divisions Groups.

Joseph E. Godfrey, Vice President, and formerly General Manager of the GM Assembly Division, was appointed Group

Driver control reach fixture enables GM Design Staff to evaluate seating comfort, accessibility of controls, and vision in proposed vehicle designs.

Opel Manta Luxus.

Clay mock-up, GM Design Staff studio.

Executive in charge of the Body and Assembly Divisions Group, succeeding Mr. Scott.

Howard H. Kehrl, Vice President, and formerly General Manager of the Oldsmobile Division, was appointed Group Executive in charge of the Car and Truck Group, succeeding John Z. DeLorean, who resigned from the Corporation.

John D. Baker, Vice President, and formerly President, General Manager and Chief Executive Officer of General Motors of Canada Limited, succeeded Mr. Kehrl as General Manager of the Oldsmobile Division. Following Mr. Baker's death on December 19, 1973, Robert J. Cook, formerly General Manufacturing Manager of Oldsmobile, was appointed to succeed Mr. Baker. Mr. Cook was elected a Vice President and becomes a member of the Administration Committee.

David C. Collier, formerly Treasurer of General Motors, succeeded Mr. Baker as President, General Manager and Chief Executive Officer of General Motors of Canada Limited. Mr. Collier was elected a Vice President of GM and becomes a member of the Administration Committee. F. Alan Smith, formerly General Assistant Treasurer, succeeded Mr. Collier as Treasurer.

Charles Katko, formerly Manager of the Manufacturing Staff Activity of GM Assembly Division, was appointed General Manager of that Division, succeeding Joseph E. Godfrey. Mr. Katko was elected a Vice President and becomes a member of the Administration Committee.

George W. Griffith, who was Works Manager of the Hydra-matic Division, was appointed General Manager of that Division, succeeding J. Stewart Garlic, who retired.

Robert W. Truxell, formerly Manager of Production, Purchasing and Traffic for Oldsmobile Division, was appointed General Manager of Delco Moraine Division, replacing Norman L. Gebhart, who retired.

Glenn W. Wiegand, formerly Special Assistant to the President for Assembly and Fabrication, was appointed General Manager of Harrison Radiator Division, succeeding Lawrence A. Zwicker, who retired.

Donald J. Atwood, formerly Manager, Indianapolis Operations, Detroit Diesel Allison Division, was named General Manager of the newly created GM Transportation Systems Division.

Thomas E. Darnton, formerly General Director of Purchasing, Production Control and Traffic for Chevrolet, was appointed Executive in charge of Service Parts Operations which coordinates within GM the supply, distribution, and marketing of car and truck service parts of GM Parts and United Delco Divisions, and the service parts aftermarket activities of GMC Truck & Coach and AC Spark Plug Divisions.

The People of General Motors

General Motors established new records for both worldwide employment and payrolls in 1973. Average worldwide employment was 811,000 men and women and payrolls totaled $10,309 million. For 1972, average worldwide employment was 760,000 and payrolls amounted to $8,668 million. In the 1973 fourth quarter, worldwide employment averaged 832,000 and payrolls were $2,662 million, compared with 796,000 and $2,298 million in the 1972 fourth quarter.

Average hourly employment in the United States in 1973 was 447,000 and payrolls totaled $6,153 million. Wages, including shift premiums and other income, for these employes averaged $6.46 per hour for a workweek of 40.9 hours. This compares with $6.00 per hour for

In 1973, more than one million Chevrolet trucks were sold, making Chevrolet the leading producer and seller of trucks in the U.S.

Frigidaire 3-speed Jet Action automatic washer.

an average workweek of 40.3 hours in 1972.

For comparison purposes, the average weekly wage of GM's hourly employes in the United States in 1973 was $264.58, or 60% above the average weekly earnings for all manufacturing employes in the U.S. as reported by the Bureau of Labor Statistics.

In December 1973, GM announced production schedule adjustments in view of the decreased demand for full-size cars. As a result, it was necessary to eliminate the second shift in some plants, reduce production rates in others, and to shut down some plants for periods up to ten days.

Although GM regrets the need for an employe layoff for any reason, the Corporation found it necessary to respond to the market by taking this action. This adjustment in the work force follows about three years of steadily increasing employment.

According to contractual agreements and personnel policies, most layoffs are made on the basis of the employes with the least seniority being laid off first. Because of the advances made by GM in recent years in hiring women and minorities, these two groups unfortunately represent a large number of those employes being laid off. The effect of these layoffs is cushioned by the benefit plans provided by GM, particularly Supplemental Unemployment Benefits. Once it becomes possible to recall employes, GM is confident that the gains made in employment of women and minorities will be restored.

Performance Improvement Increase

Effective September 16, 1973, most eligible salaried employes in the U.S. (primarily those whose salaries are below $26,000 per year) received performance improvement increases ranging from $40 to $100 a month. In addition, $60.67 of the cost-of-living allowance was transferred, effective December 1, 1973, to monthly base salaries, leaving $26.00 for inclusion in future quarterly cost-of-living allowances.

New Labor Agreement

A new three-year contract covering all economic and national contract matters for UAW-represented GM employes in the United States became effective on December 10, 1973. However, some local issues still remain to be settled. GM also concluded negotiations with the IUE and other unions representing certain of the Corporation's U.S. workers. Benefits for most of these employes closely parallel the provisions of the GM-UAW contract.

The major economic provisions of the new UAW labor contract are:

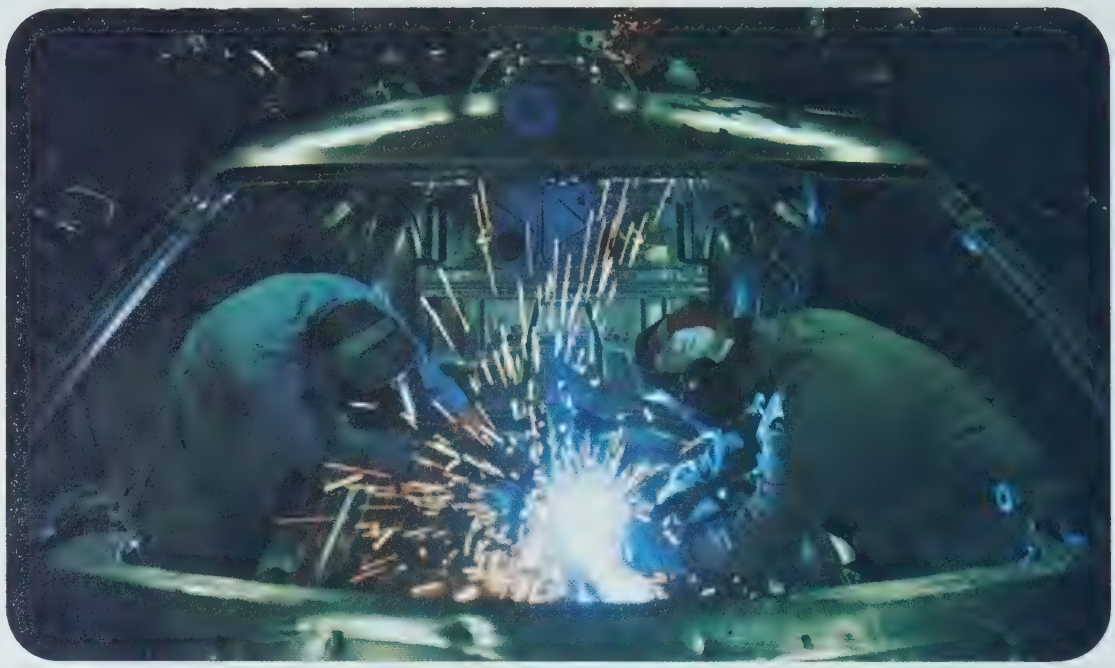
The agreement provides for a wage increase of 23 cents to 35 cents an hour, depending on the employe's base rate. The increase became effective September 15, 1973. Including this average increase and the December cost-of-living adjustment of 12 cents per hour, the average straight time hourly wage rate for GM's hourly employes at the end of the year was $5.56 compared with $5.18 prior to GM's current labor agreements.

Annual improvement factor wage increases of 3%, ranging from 12 to 26 cents an hour, will be granted in September of 1974 and 1975.

Effective December 10, 1973, 35 cents of the 40-cent per hour cost-of-living allowance (COLA) was transferred to the hourly rates of employes. Under the new contract's modified COLA formula, five cents of the allowance will be continued. The agreement also provides that as much as 10 cents of the COLA generated during the remainder of the agreement may be deducted from the future increases in cost-of-living allowance. This

Work continues at GM Research in developing new concepts in fuel cells (shown above) and high-energy density batteries.

Body assembly, Fisher Body Division's Pontiac plant.



Chevrolet Caprice Classic Coupe.

money will help defray the cost of benefit plan improvements, such as the new dental plan.

The new contract also provides for a six-year pension agreement which includes substantial improvements. Subject to approval at the next stockholders' meeting, basic pension benefits for persons retiring after September 14, 1973, will be increased from a range of $7.25 to $7.75 to a range of $10.75 to $11.50 per month per year of service by October 1, 1978. Unreduced basic benefits will be payable after age 65 for employes with 30 or more years of service on or after October 1, 1973. Effective October 1, 1975, employes retiring with 30 or more years of service will receive a new lifetime supplement, after age 65, which ranges from $75 a month for retirements beginning March 1, 1974 to $100 a month for retirements beginning October 1, 1978. Both basic benefits and the supplement are payable in addition to Social Security. Employes with 30 or more years of service will be able to retire with benefits of up to $700 per month for life, including Social Security benefits, after October 1, 1978.

Effective October 1, 1974, comprehensive dental expense coverage will be provided for active employes with at least one year's seniority and for their eligible dependents. Benefits for preventive, restorative, and prosthetic services will be provided to a maximum of $750 a year. In addition, the plan provides for a maximum lifetime benefit of $500 for orthodontic services for dependent children under age 19.

Changes in the Supplemental Unemployment Benefit Plan were made to provide additional funding. Basic Corporation contributions will range from seven cents to 12 cents per hour, compared with a range of five to 10 cents under the previous agreement. Effective January 5, 1976, the basic contribution schedule will be increased to a range of nine to 14 cents per hour.

Insurance improvements include higher amounts of insurance as a result of increased wages, and effective October 1, 1975, increased life insurance and survivor income benefits and certain improvements in hospital, medical, and prescription drug expense benefits.

Other changes include improvements in holiday pay and in the Corporation's Tuition Refund Program, and in addition, new procedures were agreed upon with respect to voluntary overtime, health and safety, and subcontracting.

In Canada, a new agreement between the UAW and GM of Canada Limited became effective on December 17, 1973. The new agreement includes a combination of wage increases and improved benefits generally in line with the U.S. settlement.

GM Employe Benefit Programs

In 1973, GM contributed a record $1.7 billion to employe benefit programs in the U.S. These programs offer hourly and salaried employes in the U.S. help in planning for the future and in providing security for themselves and their families.

The Insurance Program provided by GM is an extremely comprehensive Program, responsive to the needs of all employes. In 1973, the cost of this Program amounted to more than $870 million. The Program protects GM employes and eligible dependents against a number of contingencies. Effective October 1, 1974, a comprehensive dental program for active salaried employes (and their eligible dependents) with one year of service will be provided.

The Pension and Retirement Programs are also of major importance to General Motors employes. The Programs provide monthly

Below—Installation of GMC Truck & Coach Division's new boiler equipment designed to burn solid industrial wastes to produce steam power.

Above—GM's Basic Transportation Vehicle is now being produced and marketed in six countries.

The On-Car Tire Grinder, developed to improve vehicle servicing, corrects road shake by duplicating the grinding done on original equipment tires.

Right—A Service Research Section development is this device that simplifies hood removal for engine servicing.

retirement benefits for eligible employes and their eligible surviving spouses. In 1973, the Corporation contributed nearly $625 million to the Pension and Retirement Programs in the United States. Proposed improvements in these Programs will be submitted to stockholders for approval.

GM also provides plans which minimize the effect of a layoff. Hourly employes are covered by either the Supplemental Unemployment Benefit Plan or the Income Security Plan. Salaried employes are protected under the Separation Allowance Plan and a new Layoff Benefit Plan effective in 1974. General Motors contributed nearly $110 million for these Plans in 1973.

The General Motors Savings-Stock Purchase Program provides eligible salaried employes with a sound and systematic way to increase savings. In 1973, 90% of eligible salaried employes in the U.S. saved an average of 8% of their salaries. GM contributed $69 million to the Program in 1973, and during the year 3,159,000 shares of GM common stock for the Program were purchased in the open market. Effective January 1, 1974, a number of improvements were made in the Savings-Stock Purchase Program, including: reduction of class maturity period from five years to three years, commencing with the 1972 class; and acceleration of the maturity of classes formed in 1969 through 1971 to provide a transition to the three-year vesting.

During 1973, more than $15 million was awarded to employes in the U.S. for suggestions adopted under the General Motors Suggestion Plan.

Benefit plans in Canada are similar to those in effect in the United States. Plans at overseas locations vary and are in accord with local custom.

Educational Aid for GM Employes

In addition to the Corporation's support to higher education and the GM Scholarship Program, General Motors also extends educational aid to its employes through the Tuition Refund Plan. Under this Plan, GM now reimburses employes in an amount up to $700 each year (an increase of $200 from 1973) for the satisfactory completion of approved courses related to their field of work at an accredited college or university. For any other approved courses, GM reimburses employes in an amount up to $350 per year. In 1973, employes studying under the Plan were awarded 197 bachelor degrees and 161 graduate degrees. Refunds under the Plan and individual graduate fellowships granted to employes by the Corporation in 1973 totaled $2.9 million.

Another way in which GM is meeting the needs of higher education is through General Motors Institute, a five-year fully-accredited college in Flint, Michigan. In 1973, more than 3,000 students attended GMI, including 412 minorities and 247 women. GMI provides an opportunity to earn degrees in engineering and industrial administration through a cooperative program. Students alternate periods of academic study and paid related work assignments at sponsoring GM Divisions. The Institute also conducts a wide range of management and continuing education courses for GM employes. Currently, 88 minority students—26 of whom are women, are enrolled in an experimental pre-freshman program at GMI. The program has been established for scholastically qualified applicants who were inadequately prepared for engineering studies because of the lack of a proper high school curriculum and thus would have been denied admission. Expenditures for GMI in 1973 were $11.6 million, compared with $10.3 million in 1972.

GM Design Staff's Interior and Color Studio provides designers a spectrum of color plates and textiles for study.

TEREX off-highway scraper.

Complete engine assemblies used for design check analysis of pre-production prototypes, Chevrolet Engineering Center.

Incentive Program

The Incentive Program consists of the Bonus Plan and Stock Option Plan. The Bonus and Salary Committee of the Board of Directors, which administers this Program, has not yet determined the number of participants who may be awarded bonuses or granted stock options related to the year 1973. The computation of the maximum amount which may be credited to the reserve maintained for purposes of the Incentive Program is shown on page 40.

Equal Employment Opportunity

General Motors is one of the largest private employers of minority Americans. The percentage of minority employment in GM has grown from 11.2% of our U.S. work force in 1965 to 17.7% at the end of 1973. Gains of minorities in white-collar jobs have been even more rapid, increasing from 1.7% in 1965 to 8.8% at the end of 1973.

In 1965, women accounted for 12.9% of GM's work force. By December 1973, this percentage had risen to 15.2%. As of December 31, 1973, General Motors employed approximately 97,000 women—over 4,300 of them in management, professional, and technical capacities.

These increases in the employment of minorities and women are the result of GM's long-standing policy to provide equal employment to all qualified applicants and an equal opportunity for advancement to all employes regardless of race, religion, national origin, age, or sex. Consistent with this policy and in light of our continually increasing obligations under Federal and state laws and regulations dealing with equal opportunity employment, General Motors several years ago implemented a variety of affirmative action programs designed to increase the utilization of minorities and women in all levels of the work force.

The success of these programs is reflected in the substantial progress achieved by the Corporation during 1973 in the employment of minorities and women. In this period of economic growth, minority employment was increased by over 11,000, from approximately 102,000, or 16.7% of total employment at the end of 1972, to over 113,000, or the 17.7% noted previously. At the same time, more than 12,000 women were added to the GM work force.

In view of GM's progress under these programs, it is difficult to understand the filing of a charge against General Motors by the Federal Equal Employment Opportunity Commission alleging discriminatory employment practices in eight Divisions. Similar charges were filed against three other major U.S. employers and a number of unions. GM intends to defend its equal employment program vigorously before the Commission.

General Motors Stockholders

There were 1,306,000 General Motors stockholders at the end of 1973. They live in every state, in each of the Canadian provinces and territories, and in approximately 90 other countries.

Of the preferred and common stockholders, 69% are individual accounts, 20% joint tenant accounts, and 11% institutions and groups, such as colleges, pension funds, and insurance companies. Of GM's owners, 40% own 25 shares or less and 78% own 100 shares or less.

The Dividend Reinvestment Plan provides a convenient, economical method for GM stockholders to obtain additional shares through the automatic reinvestment of their dividends. Approximately 108,000—or about 8%—of GM's stockholders are participating in the Plan.

Special Report:

The GM Proving Grounds

Testing the splash protection of brakes, electrical system, seals, and air intakes in the 1,000-foot "bathtub" at the Milford Proving Ground.

Raymond R. Higgens, test driver at the Desert Proving Ground, prepares for a tire test run.

50 Years of Automotive Testing

Located about an hour's drive from Detroit is the world's largest and most sophisticated automotive test facility—the General Motors Milford Proving Ground, operated by the GM Engineering Staff. Established in the spring of 1924, the Milford site has grown in 50 years from 1,125 acres and seven miles of test roads to 4,009 acres and 79 miles of every kind of road surface imaginable.

Today, Milford is headquarters for the General Motors Proving Grounds system in the United States, which includes the Desert Proving Ground, located on more than 4,000 acres Southeast of Mesa, Arizona; the Pikes Peak Test Headquarters at Manitou Springs, Colorado; and Vehicle Emissions Laboratories at Denver, Colorado and Van Nuys, California. GM also has a cold-weather test site, maintained by General Motors of Canada Limited at Kapuskasing, Ontario. Overseas, there are major GM proving ground facilities in the Federal Republic of Germany, England, and Australia. A new facility is under construction in Brazil.

The proof of any automotive design innovation is the road test. The only way to find out if a new design will perform as intended is to test it in mile-after-mile driving over roads that simulate the real-life conditions under which vehicles operate. The Proving Grounds' wide range of environmental conditions and terrain provides the diverse driving situations required. The many scientifically controlled test procedures and sophisticated instrumentation developed by the Proving Grounds provide the means to analyze and evaluate the design before production.

Today, the primary function of the GM Proving Grounds remains the same as when originally established—to test, measure, evaluate, and learn all the facts about GM vehicles before they reach the hands of customers and to make certain that all GM vehicles provide the value, reliability, durability, safety, performance, and economy that collectively comprise customer appeal and satisfaction.

Above—The 4.5-mile circular test track at the Milford Proving Ground—one of the basic roads used for development tests and studies.

Left—One of the tests performed in the 115,000 miles driven during an average 24-hour period is this durability test run over a dusty trail near the Desert Proving Ground.

Far left—The Milford Proving Ground's vast network of test roads simulates a worldwide variety of driving conditions.

A crash into a 92-ton concrete barrier—the ultimate test of an automobile's safety integrity. The car carries test dummies as passengers plus highly sophisticated instrumentation which provides data for post-test evaluation. In 1973, GM crash-tested 335 cars.

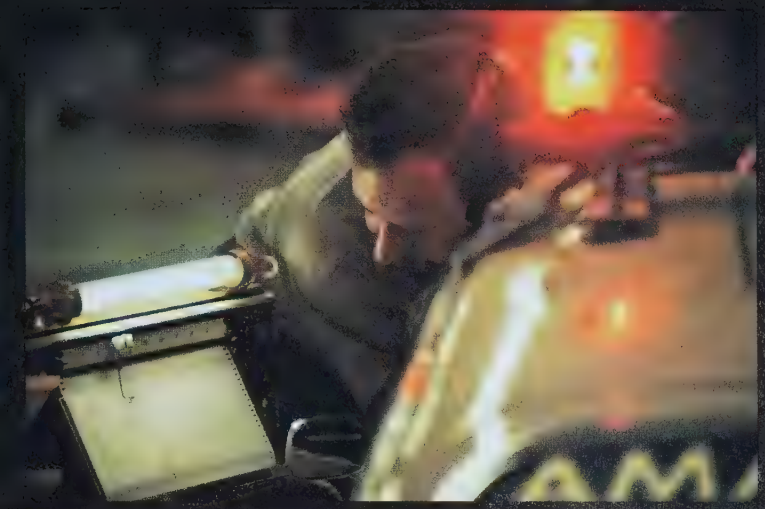
Daniel L. Raglin, project technician, readies articulated and instrumented dummies for a crash test.

Left—Joe Wilson (left), senior engineering associate, and Harry Whaling, senior project technician, inspect the underside of a car after a barrier crash test. The painted marks serve as reference points during a high-speed motion picture analysis of the test.

Above—The impact sled at the Milford Proving Ground duplicates crashes or collisions with a high degree of repeatability. The test dummy simulates the reactions of humans to collision forces and helps achieve the major objective of GM's safety program—greater protection for occupants.

Below—Brake test. The cone is part of a radar system to determine accurate car speed. The antenna on top sends test data, such as brake line pressure, to a remotely located computer for processing. The fifth wheel trailing the test car serves as an electric speedometer.

Right—The Belgian Block road. Ten miles of test driving over a durability schedule, which includes the Belgian Blocks, equal about 100 miles of severe customer driving.



Left—Henry L. Baron, dynamometer operator, adjusts instrumentation prior to running an emissions test.

Below—Eric G. Dawson, senior project tester, intently watches a strip chart trace of car speed while "driving" a test car on a dynamometer during an emissions test at the Milford Proving Ground.

This nighttime scene at the Milford Proving Ground symbolizes the endless miles that are driven 24 hours a day, day-in day-out, in all kinds of weather in GM's continuing efforts to provide its customers with the finest vehicles possible.

Financial Review

Operating results for 1973 reached record levels, reflecting a significant increase in sales volume and mirroring the general strength of the economy during most of the year. Improved operating efficiencies due to continuing cost-reduction efforts and a high level of capacity utilization during the year also contributed to the increase in earnings. The record operating results were achieved in spite of the energy related downturn in the fourth quarter and increased labor costs resulting from the labor contract settlements. These factors contributed substantially to a decrease in fourth quarter worldwide factory sales, which totaled 2,138,000 units, a reduction of 107,000 units or 5% from 2,245,000 units in the 1972 period. Earnings per share of common stock were $1.80 in the fourth quarter of 1973, a decline of $0.52, or 22% from the 1972 period earnings of $2.32 per share. Dollar sales totaled $9,015 million, slightly above the $8,819 million in the 1972 quarter. Net income was $517 million, compared with $667 million in the 1972 fourth quarter. The reduction in earnings reflects the lower unit volume but more particularly the continuing increase in labor and material costs, not only in the U.S., but throughout the world. Late in the year, price increases on U.S. vehicles were implemented, but these will only partially offset the cost increases being experienced in this country.

Net income in 1973 was $2,398 million and earnings per share of common stock were $8.34 per share, compared to the previous records of $2,163 million and $7.51 per share, respectively, set in 1972. Despite the records set in 1973, the erosion of the profit margin continues. Profit as a percent to sales declined to 6.7% in 1973 from 7.1% in 1972, even though net income increased by 10.9%. The lower profit margin in 1973 again points out the continuing problem of cost increases, including those for improvements in our products, which were only partially recovered in price increases.

Throughout the world, dollar sales of GM products totaled a record $35.8 billion, compared with $30.4 billion in 1972, the previous record year. Before elimination of intercompany sales among United States, Canadian, and Overseas operations, United States operations accounted for 77% of worldwide dollar sales in 1973, with Canadian and Overseas operations contributing 8% and 15%, respectively.

Estimated net income attributable to United States operations was 86% of total net income for 1973. Net income attributable to Canadian and Overseas operations was 5% and 9%, respectively, of the 1973 total. These percentage contributions to sales and net income are comparable to those in recent years, except for 1970, when United States and Canadian operations were adversely affected by the United Automobile Workers strike. Of the total of such income attributed to United States operations in 1973, approximately 97% was accounted for by automotive products and the remainder by nonautomotive and defense and space products.

Dividends paid on the common stock totaled $5.25 per share in 1973, compared with $4.45 per share in 1972. The dividend paid in 1973 approximated the maximum permitted by the dividend guidelines issued by the Government's Committee on Interest and Dividends.

Prices

The average manufacturer's suggested retail price of GM's 1974 equipped passenger cars and trucks sold in the United States increased $261, or 5.3%, over comparably equipped 1973 models.

At 1974 model introduction, prices were increased an average of $73, or 1.5%, to partially recover the costs of Government-mandated 1974 safety equipment added to the vehicles. As indicated in GM's request for a price increase to the Cost of Living Council (COLC) on August 14, 1973, the cost of both Federally-mandated equipment and GM-initiated product safety improvements averaged $102 on 1974 vehicles. Public hearings were subsequently held and the COLC limited its approval to the $73 average.

In light of the labor agreement negotiated with the UAW and other unions during 1973 and due to other cost increases for materials and purchased components, General Motors filed a second request for price increases with the COLC on November 8, 1973. In that request, cost increases of $208 were displayed. However, GM requested a price increase of only $150 at the wholesale level. After providing for a normal markup to dealers, the increase would average $188, or 3.8% of the suggested retail price. After public hearings were held, the COLC exempted from Phase IV controls prices of automobiles, trucks, and buses manufactured by the four major automobile companies. As a condition of the exemption, GM agreed to forego further price increases during the 1974 model year unless forced to increase prices by major unforeseen economic events. On December 13, 1973, GM increased its suggested retail prices by the requested amount.

Taxes

The provision for United States, foreign and state and local income taxes in 1973 was $2,115 million, compared with $2,060 million in 1972. Together with other state and local taxes and General Motors' share of social security taxes, the total tax provision in 1973 was $3,206 million, compared with $2,978 million in 1972. In 1973, this total tax provision was equivalent to $1.34 for every dollar of net income and $11.21 per share of common stock, which compares to $1.38 for every dollar of net income and $10.41 per share in 1972.

Expenditures for Plant, Equipment and Special Tools

Expenditures for plant and equipment throughout the world totaled $1,163 million in 1973, and provided for capacity expansion, modernization, and plant replacements. Of these expenditures, approximately 81% were made in the United States, 4% in Canada and 15% overseas. In 1972, spending for plant and equipment totaled $940 million. Depreciation charged to income in 1973 was $903 million, compared with $912 million in 1972.

Expenditures for special tools were $941 million in 1973 and $898 million in 1972. Tool amortization amounted to $1,081 million in 1973 and $874 million in 1972.

Working Capital

Working capital at December 31, 1973, totaled $6,197 million, an increase of $632 million over the $5,565 million working capital at December 31, 1972. The increase in 1973 is more than accounted for by the excess of net income over dividends paid to stockholders of $884 million. Partially offsetting this increase are decreases due to the excess of expenditures for property over depreciation and amortization of $120 million and increased investments in nonconsolidated subsidiaries and associates of $158 million. A statement setting forth the changes in financial position and the changes in working capital by element appears on page 34.

Common Stockholders' Equity

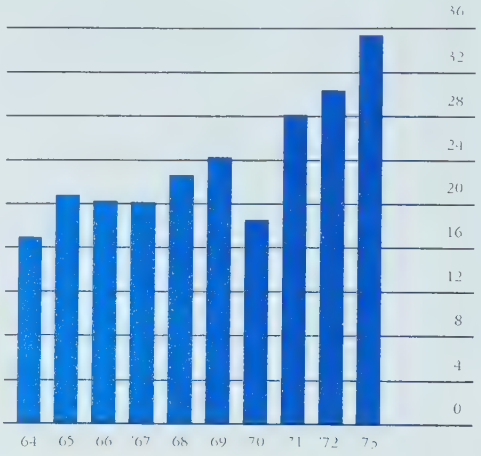
The equity of the holders of General Motors common stock is represented by the common stock, capital surplus and net income retained for use in the business. This amounted to $12,283 million at the end of 1973, compared with $11,399 million at the end of 1972. Book value per share of General Motors common stock increased to $42.71 at the end of 1973, from $39.64 at the end of 1972.

Pension Funds

Under the pension plan for hourly employes and the trusteed part of the retirement program for salaried employes, pension funds in the United States are managed by a group of independent bank trustees. Stated at cost, these funds totaled $3.9 billion at the end of 1973. General Motors payments into the trusts and net income earned by the trusts totaled $704 million during 1973. Reflecting pension payments amounting to $349 million, the resulting net increase in the pension funds for the year amounted to $355 million. Details are shown in the tabulation on page 40.

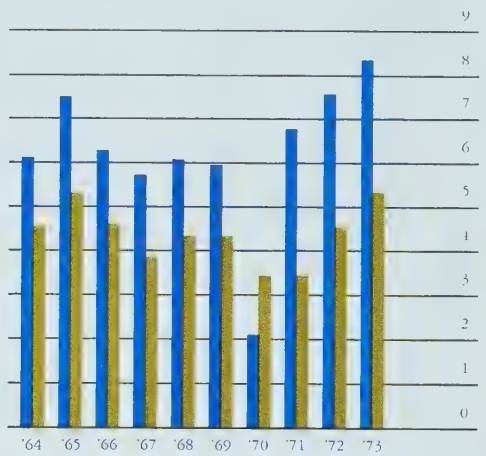
Three insurance companies administer the insured part of the U.S. salaried employes' retirement program. Separate arrangements are made for employes in Canada and other countries where General Motors pension plans are in effect.

Dollar Sales — billions of dollars



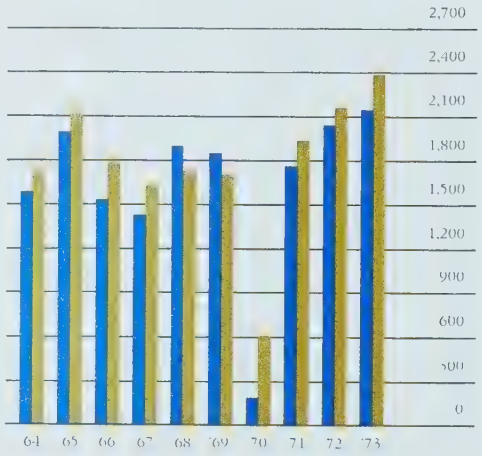
Earned Per Share of Common Stock — dollars

income earned
dividends paid



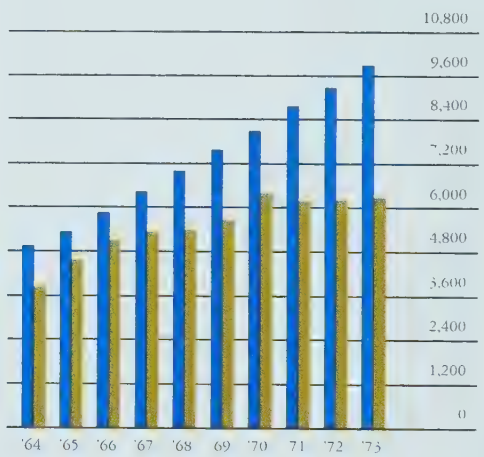
Income Taxes and Net Income — millions of dollars

U.S., foreign and other income taxes
net income

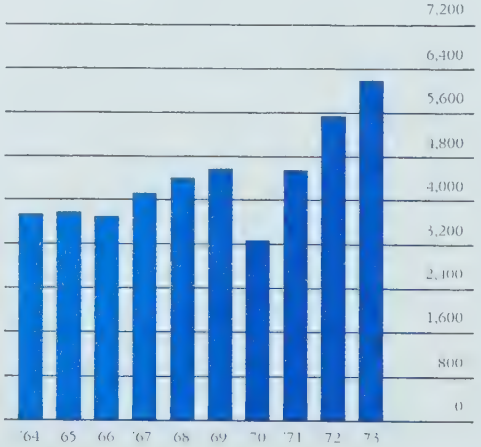


Property — millions of dollars

accumulated depreciation
net property

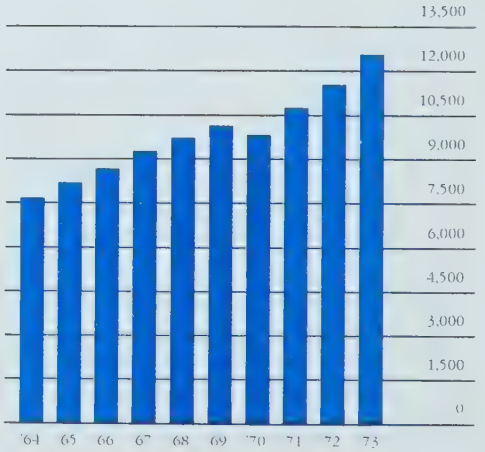


Working Capital — millions of dollars



Stockholders' Equity — millions of dollars

common and preferred stockholders



Statement of Consolidated Income

for the years ended December 31, 1973 and 1972

General Motors Corporation and Consolidated Subsidiaries

	1973	1972
Net Sales	$35,798,289,281	$30,435,231,414
Equity in earnings of nonconsolidated subsidiaries and associates (dividends received amounted to $48,465,758 in 1973 and $53,894,756 in 1972)	102,984,258	103,733,982
Other income less income deductions (Note 2)	150,687,254	71,045,353
Total	36,051,960,793	30,610,010,749
Costs and Expenses		
Cost of sales and other operating charges, exclusive of items listed below	28,114,073,825	23,336,854,644
Selling, general and administrative expenses	1,328,085,680	1,162,537,263
Depreciation of real estate, plants and equipment	902,853,471	912,432,511
Amortization of special tools	1,081,020,914	874,221,875
Provision for the Incentive Program (Note 11)	112,823,495	101,357,691
United States, foreign and other income taxes (Note 3)	2,115,000,000	2,059,800,000
Total	33,653,857,385	28,447,203,984
Net Income	2,398,103,408	2,162,806,765
Dividends on preferred stocks	12,928,269	12,928,270
Earned on Common Stock	$ 2,385,175,139	$ 2,149,878,495
Average number of shares of common stock outstanding	286,035,632	286,099,648
Earned Per Share of Common Stock (Note 12)	$8.34	$7.51

Reference should be made to notes on pages 35 through 39.

Consolidated Balance Sheet

December 31, 1973 and 1972

Assets	1973	1972
Current Assets		
Cash	$ 387,131,788	$ 379,618,630
United States and other government securities and time deposits—at cost, which approximates market:		
Held for payment of income taxes	498,525,392	603,715,489
Other	2,160,446,064	1,963,607,352
Accounts and notes receivable (Note 4)	3,082,503,470	2,806,202,114
Inventories	5,176,896,457	4,200,163,355
Prepaid expenses	861,001,813	585,214,833
Total Current Assets	12,166,504,984	10,538,521,773
Investments and Miscellaneous Assets		
Equity in net assets of nonconsolidated subsidiaries and associates (Note 5)	1,354,497,010	1,141,536,540
Other investments and miscellaneous assets—at cost (less allowances)	111,060,531	93,256,312
Total Investments and Miscellaneous Assets	1,465,557,541	1,234,792,852
Common Stock Held for the Incentive Program (Note 6)	137,407,501	129,540,350
Property		
Real estate, plants and equipment (Note 7)	15,615,898,926	14,748,057,536
Less accumulated depreciation (Note 7)	9,945,321,053	9,270,232,890
Net real estate, plants and equipment	5,670,577,873	5,477,824,646
Special tools—less amortization	580,657,543	720,699,933
Total Property	6,251,235,416	6,198,524,579
Deferred Charges		
Goodwill—less amortization	38,065,480	44,409,726
Deferred income taxes and other deferred charges	238,090,497	127,592,755
Total Deferred Charges	276,155,977	172,002,481
Total Assets	$20,296,861,419	$18,273,382,035

Reference should be made to notes on pages 35 through 39.

Liabilities, Reserves and Stockholders' Equity	1973	1972
Current Liabilities		
Accounts, drafts and loans payable	$ 3,275,680,774	$ 2,469,823,840
United States, foreign and other income taxes payable	605,306,296	760,322,253
Accrued liabilities	2,088,666,739	1,743,600,748
Total Current Liabilities	5,969,653,809	4,973,746,841
Long-Term Debt (principally foreign subsidiaries) (Note 8)	756,517,807	790,876,437
Other Liabilities	462,539,708	380,365,697
Deferred Credits and Reserves		
Deferred investment tax credits	178,833,236	169,838,391
Contingent credits under Stock Option Plan	18,100,000	21,100,000
General reserve applicable to foreign operations	141,667,396	141,667,396
Other (principally deferred translation gains and intercompany profits) (Note 9)	202,772,836	112,908,250
Total Deferred Credits and Reserves	541,373,468	445,514,037
Stockholders' Equity (Notes 10 and 11)		
Capital stock:		
Preferred:		
$5.00 series	183,564,400	183,564,400
$3.75 series	100,000,000	100,000,000
Common	479,361,735	479,360,875
Total capital stock	762,926,135	762,925,275
Capital surplus (principally additional paid-in capital)	766,979,178	766,945,776
Net income retained for use in the business	11,036,871,314	10,153,007,972
Total Stockholders' Equity	12,566,776,627	11,682,879,023
Total Liabilities, Reserves and Stockholders' Equity	$20,296,861,419	$18,273,382,035

Statement of Changes in Consolidated Financial Position

General Motors Corporation and Consolidated Subsidiaries

for the years ended December 31, 1973 and 1972

	1973	1972
Source of Funds		
Net income	$2,398,103,408	$2,162,806,765
Depreciation of real estate, plants and equipment	902,853,471	912,432,511
Amortization of special tools	1,081,020,914	874,221,875
Undistributed earnings of nonconsolidated subsidiaries and associates, deferred income taxes, etc.—net	(149,269,638)	(98,357,457)
Total current operations	4,232,708,155	3,851,103,694
Proceeds from disposals of property	67,814,754	57,171,936
Proceeds from sale of newly issued common stock	32,637	706,164
Other—net	142,961,339	84,507,720
Total	4,443,516,885	3,993,489,514
Application of Funds		
Dividends paid to stockholders	1,514,240,066	1,285,994,571
Expenditures for real estate, plants and equipment	1,163,421,452	940,037,584
Expenditures for special tools	940,978,524	898,542,491
Decrease (Increase) in long-term debt	34,358,630	(175,259,397)
Investments in nonconsolidated subsidiaries and associates	158,441,970	9,786,630
Total	3,811,440,642	2,959,101,879
Increase in working capital	632,076,243	1,034,387,635
Working capital at beginning of the year	5,564,774,932	4,530,387,297
Working capital at end of the year	$6,196,851,175	$5,564,774,932
Increase (Decrease) in Working Capital by Element		
Cash, government securities and time deposits	$ 99,161,773	($ 395,185,967)
Accounts and notes receivable	276,301,356	81,988,467
Inventories	976,733,102	208,594,182
Prepaid expenses	275,786,980	106,417,795
Accounts, drafts and loans payable	(805,856,934)	(263,513,545)
United States, foreign and other income taxes payable	155,015,957	975,507,081
Accrued liabilities	(345,065,991)	320,579,622
Increase in working capital	$ 632,076,243	$1,034,387,635

Reference should be made to notes on pages 35 through 39.

Note 1. Significant Accounting Policies

Principles of Consolidation
The consolidated financial statements include the accounts of the Corporation and all domestic and foreign subsidiaries which are more than 50% owned and engaged principally in manufacturing or wholesale marketing of General Motors products. General Motors' share of earnings or losses of nonconsolidated subsidiaries and of associates in which at least 20% of the voting securities is owned is generally included in consolidated income under the equity method of accounting. Intercompany items and transactions between companies included in the consolidation are eliminated and unrealized intercompany profits on sales to nonconsolidated subsidiaries and to associates are deferred.

Translation of Foreign Currencies
Real estate, plants and equipment, accumulated depreciation and the provision for depreciation are translated into United States dollars at exchange rates in effect at the dates the related assets were acquired. Other assets, liabilities and deferred credits and reserves are translated at exchange rates in effect at the date of the balance sheet; other items of income and expense are translated at average exchange rates for the months in which the transactions occurred. Accumulated unrealized net loss from translation of foreign currency accounts of any foreign subsidiary is charged to income and accumulated unrealized net gain is deferred. Gains or losses on exchange contracts are included in costs and expenses when realized.

Income Taxes
Investment tax credits allowable under the income tax laws are deducted in determining taxes estimated to be payable currently and are deferred and amortized over the lives of the related assets. The tax effects of timing differences between pretax accounting income and taxable income (principally related to depreciation, benefit plans expense, sales and product allowances and undistributed earnings of subsidiaries and associates) are deferred, except that the tax effects of certain expenses charged to income prior to 1968 have not been deferred but are recognized in income taxes provided at the time such expenses become allowable deductions for tax purposes. Provisions are made for estimated United States and foreign taxes, less available tax credits and deductions, which may be incurred on remittance of the Corporation's share of subsidiaries' and associates' undistributed earnings included in the consolidated financial statements.

Inventories
Inventories are stated at the lower of cost or market. Cost is determined substantially by the first-in, first-out or the average cost method. Market value is current sales price less distribution cost for finished product and replacement cost for other inventories. Physical inventories are taken at all locations.

Common Stock Held for the Incentive Program
Common stock in treasury is held exclusively for payment of liabilities under the Incentive Program and is stated substantially at cost.

Property, Depreciation and Amortization
Property is stated at cost. Maintenance, repairs, rearrangement expenses and renewals and betterments which do not enhance the value or increase the basic productive capacity of the assets are charged to costs and expenses as incurred.

The annual group (composite) rates of depreciation are, with minor exceptions, as follows:

Classification of Property	Annual Group Rates
Land improvements	5%
Buildings	3½%
Machinery and equipment	8⅓% (Average)
Furniture and office equipment	6% (Average)

Depreciation is not provided in excess of 100% of the gross book amount of a given group as a whole. Depreciation on groups which are not 100% depreciated is, with minor exceptions, accrued at 150% and 100% of the applicable rate shown above for the first and second thirds, respectively, of estimated useful life and thereafter at 50% of such rate for the balance of time the assets remain in service. Use of this accelerated method accumulates depreciation of approximately two-thirds of the depreciable cost during the first half of the estimated lives of the property.

Expenditures for special tools are amortized, with the amortization applied directly to the asset account, over short periods of time because the utility value of the tools is radically affected by frequent changes in the design of the functional components and appearance of the product. Replacement of special tools for reasons other than changes in products is charged directly to cost of sales.

Goodwill
Goodwill relates to businesses acquired in 1943 and prior years and, beginning in 1970, is being amortized over a period of ten years at the rate of $6,344,246 per year, with the amortization applied directly to the asset account.

Incentive Program
A reserve is maintained for purposes of the Bonus Plan and Stock Option Plan to which may be credited each year an amount which the independent public accountants of the Corporation determine in accordance with the provisions of the Bonus Plan; however, for any year the Bonus and Salary Committee may direct that a lesser amount be credited. Bonus awards under the Bonus Plan, contingent credits under the Stock Option Plan and such other amounts arising out of the operation of the Incentive Program as the Committee may determine are charged to the reserve. As a result of tentative determinations of awards by the Committee, the amount provided is transferred to current liabilities, other liabilities and deferred credits at December 31.

If participants do not meet the preconditions entitling them to receive undelivered instalments of bonus awards and contingent credits, the amount of any such instalments is credited to income. Upon the exercise of stock options, the related contingent credits are proportionately reduced with the amount of the reduction credited to income.

Note 1. Significant Accounting Policies (concluded)

General Reserve Applicable to Foreign Operations

The general reserve applicable to foreign operations was established in 1954 and is available to absorb extraordinary losses, such as losses from discontinuing foreign operations in any locality, either voluntarily or because of conditions beyond the Corporation's control. There has been no change in this reserve since its establishment.

Pension Program

The Corporation and its subsidiaries have several pension plans covering substantially all employes. Generally, plans covering hourly-rate employes are noncontributory and those covering salaried employes are both contributory and noncontributory. Benefits under the plans are generally related to an employe's length of service, wages and salaries and contributions. The costs of these plans are determined on the basis of actuarial cost methods and include amortization of prior service cost over periods not exceeding 30 years. With the exception of certain overseas subsidiaries, pension costs accrued are funded.

Product Related Expenses

Expenditures for research and development and advertising and sales promotion are charged to costs and expenses when incurred; provisions for estimated costs related to product warranty are made at the time the products are sold.

Note 2. Other Income Less Income Deductions

	1973	1972
Other income:		
Interest income	$ 273,314,924	$ 135,375,959
Other	23,877,064	20,538,877
Income deductions:		
Interest and related charges on long-term debt	(66,033,440)	(46,771,305)
Other interest	(38,927,130)	(28,191,405)
Gain (Loss) on translation of financial statements in foreign currencies— net(a)	(14,778,701)	482,470
Other	(26,765,463)	(10,389,243)
Net	$ 150,687,254	$ 71,045,353

(a) In addition to net translation losses included in income deductions, translation gains of $67,061,457 in 1973 and $10,849,177 in 1972 were deferred and are included in Deferred Credits and Reserves—Other at the respective year-end dates.

Note 3. United States, Foreign and Other Income Taxes

	1973	1972
Taxes estimated to be payable currently (b):		
United States Federal	$1,749,899,899	$1,595,391,659
Foreign	264,634,422	279,599,443
Other	265,141,000	254,400,000
Total	2,279,675,321	2,129,391,102
Taxes deferred—net:		
United States Federal	(145,306,899)	(90,841,659)
Foreign	(8,222,267)	22,144,166
Other	(20,141,000)	(19,000,000)
Total	(173,670,166)	(87,697,493)
Investment tax credits deferred—net:		
United States Federal	7,607,000	16,150,000
Foreign	1,387,845	1,956,391
Total	8,994,845	18,106,391
Total	$2,115,000,000	$2,059,800,000

(b) Investment tax credits deducted in determining taxes estimated to be payable currently amounted to $55,518,935 in 1973 and $51,080,601 in 1972.

Note 4. Accounts and Notes Receivable

	1973	1972
General Motors Acceptance Corporation:		
Current wholesale financing of sales of General Motors products	$1,194,643,851	$1,491,529,301
Noninterest bearing loan	500,000,000	—
Total	1,694,643,851	1,491,529,301
Other trade and sundry receivables (less allowances)	1,387,859,619	1,314,672,813
Total	$3,082,503,470	$2,806,202,114

Note 5. Equity in Net Assets of Nonconsolidated Subsidiaries and Associates

	1973	1972
Nonconsolidated subsidiaries:		
General Motors Acceptance Corporation and its subsidiaries (finance and insurance companies) (See page 41)	$1,143,389,893	$ 948,002,595
Dealerships operating under dealership assistance plans (retail companies)	104,530,281	110,378,744
Other domestic and foreign subsidiaries	15,972,951	6,159,174
Associates (interests in overseas companies)	90,603,885	76,996,027
Total	$1,354,497,010	$1,141,536,540

Note 6. Common Stock Held for the Incentive Program

	1973		1972	
	Shares	Amount	Shares	Amount
Balance at beginning of the year	1,693,625	$129,540,350	1,704,658	$130,668,064
Acquired during the year	839,190	57,296,450	635,702	49,974,989
Delivered to participants during the year	(645,927)	(49,430,924)	(646,735)	(51,226,076)
Revaluation in accordance with the Bonus Plan	—	1,625	—	123,373
Balance at end of the year:				
Held for instalment deliveries of bonus awards and contingent credits related to prior years	823,807	62,428,888	765,842	57,368,659
Available for contingent credits related to outstanding stock options	175,422	13,914,493	222,601	17,168,904
Available for current bonus awards and contingent credits	887,659	61,064,120	705,182	55,002,787
Total	1,886,888	$137,407,501	1,693,625	$129,540,350

Note 7. Real Estate, Plants and Equipment and Accumulated Depreciation

	1973	1972
Real estate, plants and equipment:		
Land	$ 236,608,135	$ 214,972,179
Land improvements	515,723,635	490,121,004
Leasehold improvements—less amortization	24,312,032	23,508,032
Buildings	3,889,687,534	3,773,047,598
Machinery and equipment	10,211,856,100	9,729,677,842
Furniture and office equipment	234,844,708	232,389,352
Construction in progress	502,866,782	284,341,529
Total	$15,615,898,926	$14,748,057,536
Accumulated depreciation:		
Land improvements	$ 305,376,415	$ 285,323,752
Buildings	2,177,974,915	2,057,908,137
Machinery and equipment	7,249,030,699	6,718,011,419
Furniture and office equipment	163,608,894	159,659,452
Extraordinary obsolescence	49,330,130	49,330,130
Total	$ 9,945,321,053	$ 9,270,232,890

Note 8. Long-Term Debt (Less Current Portion)

		1973	1972
General Motors Corporation—United States dollars	1975-2000	$ 123,067,107	$116,383,137
Consolidated subsidiaries:			
United States dollars	1975-86	262,125,000	260,000,000
Canadian dollars	1976	50,200,000	100,440,000
German marks	1975-79	185,693,800	177,287,000
Swiss francs	1976	57,100,000	53,000,000
British pounds	1975-92	63,525,000	64,625,000
French francs	1975-78	6,135,000	10,302,000
Belgian francs	1975-77	911,800	1,138,000
Other currencies	1975-2003	7,760,100	7,701,300
Total		$ 756,517,807	$790,876,437

Maturities of long-term debt at December 31, 1973 for each of the five years through 1978 are: 1974—$97,632,128 (included in current liabilities); 1975—$64,607,357; 1976—$243,685,106; 1977—$129,277,631; and 1978—$30,691,051.

Note 9. Deferred Credits and Reserves—Other

	1973	1972
Deferred intercompany profits arising from sales to nonconsolidated subsidiaries	$ 71,503,826	$ 58,386,558
Deferred gains on translation of foreign currency accounts of foreign subsidiaries	103,000,709	35,939,252
Other deferred income	6,647,191	5,520,709
Miscellaneous reserves	21,621,110	13,061,731
Total	$ 202,772,836	$112,908,250

Note 10. Stockholders' Equity

	1973	1972
Capital Stock:		
Preferred Stock, without par value (authorized, 6,000,000 shares), no change during the year:		
$5.00 series, stated value $100 per share, redeemable at $120 per share (issued, 1,875,366 shares; in treasury, 39,722 shares; outstanding, 1,835,644 shares)	$ 183,564,400	$ 183,564,400
$3.75 series, stated value $100 per share, redeemable at $100 per share (issued and outstanding, 1,000,000 shares)	100,000,000	100,000,000
Common Stock, $1⅔ par value (authorized, 500,000,000 shares):		
Issued at beginning of the year (287,616,525 shares in 1973 and 287,604,280 shares in 1972)	479,360,875	479,340,467
Newly issued stock sold under provisions of the Stock Option Plan (516 shares in 1973 and 12,245 shares in 1972)	860	20,408
Issued at end of the year (287,617,041 shares in 1973 and 287,616,525 shares in 1972)	479,361,735	479,360,875
Total capital stock at end of the year	762,926,135	762,925,275
Capital Surplus (principally additional paid-in capital):		
Balance at beginning of the year	766,945,776	766,136,647
Paid-in capital in excess of par value of newly issued common stock sold under provisions of the Stock Option Plan	31,777	685,756
Increase in carrying value of common stock held for the Incentive Program revalued in accordance with the Bonus Plan	1,625	123,373
Balance at end of the year	766,979,178	766,945,776
Net Income Retained for Use in the Business:		
Balance at beginning of the year	10,153,007,972	9,276,195,778
Net income	2,398,103,408	2,162,806,765
Total	12,551,111,380	11,439,002,543
Cash dividends:		
Preferred stock, $5.00 series, $5.00 per share	9,178,220	9,178,220
Preferred stock, $3.75 series, $3.75 per share	3,750,049	3,750,050
Common stock, $5.25 per share in 1973 and $4.45 per share in 1972	1,501,311,797	1,273,066,301
Total cash dividends	1,514,240,066	1,285,994,571
Balance at end of the year	11,036,871,314	10,153,007,972
Total Stockholders' Equity	$12,566,776,627	$11,682,879,023

Note 11. Incentive Program

For the year 1973, the Bonus and Salary Committee directed a credit to the Reserve for Bonus Plan and Stock Option Plan of $112,823,495, (the maximum permitted under the Bonus Plan formula as set forth on page 40) and has tentatively determined that the total of individual awards shall approximate the amount credited to the reserve in 1973 subject, however, to the final determination of the Committee. As a result, $112,823,495 was transferred to current liabilities, other liabilities and deferred credits.

Changes during 1973 in the status of options granted under the Stock Option Plan are shown in the following table. The option prices are 100% of the average of the highest and lowest sales prices on the New York Stock Exchange on the dates the options were granted. Of the options outstanding at December 31, 1973, those granted in 1973 expire ten years from date of grant and all others expire five years from date of grant. All options are subject to earlier termination under certain conditions.

The Corporation intends to deliver newly issued stock upon the exercise of any of the outstanding options. The maximum number of shares for which additional options might be granted under the Plan was 2,539,012 at January 1, 1973 and 2,534,638 at December 31, 1973.

		Shares Under Option				
			Changes During Year			
Year Granted	Option Price	Jan. 1, 1973	Granted	Exercised	Terminated	Dec. 31, 1973
1963	$63.25	70,731	—	516	70,215	—
1968	74.50	169,026	—	—	169,026	—
1969	78.07	199,860	—	—	24,126	175,734
1970	69.82	228,192	—	—	23,061	205,131
1973	73.38	—	301,140	—	10,338	290,802
Total		667,809	301,140	516	296,766	671,667

Note 12. Earnings Per Share

Earnings per share of common stock are based on the average number of shares outstanding during each year. The effect on earnings per share resulting from the assumed exercise of outstanding options and delivery of bonus awards and contingent credits under the Incentive Program is not material.

Note 13. Foreign Operations

Net assets, sales and income attributable to operations outside the United States and Canada, included in the consolidated financial statements, are summarized in the table on page 39. Net sales include sales to United States and Canadian operations. Net income is after provisions for deferred income taxes on unremitted earnings of such foreign operations and other consolidation adjustments and, in 1973, includes earnings (loss) attributable to the major overseas manufacturing subsidiaries, as follows: Adam Opel AG, $151 million; General Motors-Holden's Pty. Limited, $27 million; and Vauxhall Motors Limited, ($9 million).

Note 13. Foreign Operations (concluded)

Net Assets Attributable to Operations Outside the United States and Canada

	December 31, 1973				
	Western Europe	United Kingdom, Australia, New Zealand and South Africa	Other, Principally Mexico and South America	Total	December 31, 1972 Total
			(In Millions)		
Assets:					
Total current assets	$ 898	$ 814	$ 533	$2,245	$1,790
Property—net	589	339	235	1,163	1,081
Other assets	31	22	150	203	146
Total assets	1,518	1,175	918	3,611	3,017
Liabilities:					
Bank borrowings and notes payable	86	174	123	383	272
Other current liabilities	366	317	220	903	768
Total current liabilities	452	491	343	1,286	1,040
Long-term debt of subsidiaries	369	65	119	553	544
Other liabilities and reserves	228	111	26	365	231
Total liabilities	1,049	667	488	2,204	1,815
Balance	$ 469	$ 508	$ 430	$1,407	$1,202
Less General Reserve Applicable to Foreign Operations				142	142
Attributable to Operations Outside the United States and Canada:					
Net Assets				$1,265	$1,060
Net Sales				$5,779	$4,741
Net Income				$ 216	$ 169

Note 14. Pension Program

The total pension expense of the Corporation and its consolidated subsidiaries amounted to $719 million in 1973 and $640 million in 1972. Late in 1973, the plans in the United States and Canada were amended, subject to stockholder approval and favorable income tax rulings, to provide for substantially increased benefits. Based on the plans prior to amendment, the actuarially computed value of vested benefits of all plans exceeded the total of pension funds, at market, and balance sheet accruals as of December 31, 1973, by about $800 million.

Note 15. Contingent Liabilities

There are various claims and pending actions against the Corporation and its subsidiaries in respect of taxes, product liability, alleged patent infringements, warranties, alleged air pollution and other matters arising out of the conduct of the business. Certain of these actions purport to be class actions, seeking damages in very large amounts. The amounts of liability on these claims and actions at December 31, 1973 were not determinable but, in the opinion of the management, the ultimate liability resulting will not materially affect the consolidated financial position or results of operations of the Corporation and its consolidated subsidiaries.

Accountants' Report

Haskins & Sells
Certified Public Accountants

1114 Avenue of the Americas
New York 10036

February 13, 1974

General Motors Corporation, its Directors and Stockholders:

We have examined the Consolidated Balance Sheet of General Motors Corporation and consolidated subsidiaries as of December 31, 1973 and 1972 and the related Statements of Consolidated Income and Changes in Consolidated Financial Position for the years then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, these financial statements present fairly the financial position of the companies at December 31, 1973 and 1972 and the results of their operations and the changes in their financial position for the years then ended, in conformity with generally accepted accounting principles consistently applied.

Haskins & Sells

Pension Funds Held by Trustees in the United States

Under the Hourly-Rate Pension Plan and the Trusteed Part of the Retirement Program for Salaried Employes

Funds at December 31, 1972—with securities valued at cost		$3,555,429,198
Additions during 1973:		
Payments by General Motors into trusts	$ 538,000,000	
Interest and dividends received	174,727,269	
Net losses realized on sales of securities	(8,590,676)	
Net additions before pension payments	$ 704,136,593	
Pension payments during 1973	348,983,386	355,153,207
Funds at December 31, 1973—with securities valued at cost		$3,910,582,405

Note: Payments by General Motors into trusts include an estimated $304 million attributable to prior service benefits provided under the original plan and by subsequent amendments. The cost of these prior service benefits is being amortized over 30 year periods from the dates the benefits were provided. The funds in these trusts include amounts applicable to nonconsolidated subsidiaries and are held for payment of pension benefits and are not the property of the Corporation or any of its subsidiaries.

Incentive Program

The Incentive Program consists of the General Motors Bonus Plan, first approved by stockholders in 1918, and the General Motors Stock Option Plan, adopted in 1957. The By-Laws provide that the Plans shall be presented for action at a stockholders' meeting at least once in every five years. In that connection both Plans were approved by the stockholders at the 1972 Annual Meeting.

The Corporation maintains a reserve for purposes of the Bonus Plan and the Stock Option Plan, to which may be credited each year an amount which the independent public accountants of the Corporation determine to be 8% of the net earnings which exceed 7% but not 15% of net capital, plus 5% of the net earnings which exceed 15% of net capital, but not in excess of the amount paid out as dividends on the common stock during the year. However, for any year the Bonus and Salary Committee may direct that a lesser amount be credited. Bonus awards under the Bonus Plan, contingent credits under the Stock Option Plan, and such other amounts arising out of the operation of the Incentive Program as the Committee may determine are charged to the reserve.

Maximum Amount which may be Credited to the Reserve As Determined by the Independent Public Accountants:

Computation of net capital:			
Amounts at December 31, 1972 included in the Consolidated Balance Sheet, page 33:			
Total stockholders' equity			$11,682,879,023
Long-term debt of General Motors Corporation			117,951,140
Total			11,800,830,163
Add proportionate allowance for net increase during the year in capital stock, capital surplus and debt:			
Increase arising from sales of 516 shares of newly issued common stock under the provisions of the Stock Option Plan	$ 31,117		
Increase arising from net increase in long-term debt of General Motors Corporation in the principal amount of $6,859,296	1,604,125		1,635,242
Net capital (as defined in the Bonus Plan)			$11,802,465,405
Computation of net earnings for determination of credit:			
Net income reported in the Statement of Consolidated Income, page 31			$ 2,398,103,408
Add amounts charged to income:			
Provision for Bonus Plan and Stock Option Plan			112,823,495
Interest and discount on long-term debt of General Motors Corporation			5,251,662
Total			2,516,178,565
Deduct amounts credited to income:			
Portions of prior years' bonus awards which could not continue to be earned under the terms of the Bonus Plan	$ 45,184		
Reduction in contingent credits resulting from exercise of stock options under the Stock Option Plan during the year	9,248		54,432
Net earnings (as defined in the Bonus Plan)			2,516,124,133
Deduct 7% on net capital (equivalent to $2.82 per share of common stock)			826,172,578
Portion of net earnings upon which the maximum credit to the reserve is computed:			
Net earnings between 7% and 15% of net capital	$ 944,197,233		
Net earnings which exceed 15% of net capital	745,754,322		$ 1,689,951,555
Maximum amount which may be credited to the reserve:			
8% of the net earnings between 7% and 15% of net capital	$ 75,535,779		
5% of the net earnings which exceed 15% of net capital	37,287,716		$ 112,823,495

Amount Available for Bonus Awards and Contingent Credits:

Credit to the reserve as directed by the Bonus and Salary Committee	$ 112,823,495
Add unawarded balance in reserve carried forward from 1972	1,877,132
Total amount available in the reserve for awards under the Bonus Plan and for contingent credits under the Stock Option Plan	$ 114,700,627

Provisions for Bonus Plan and Stock Option Plan

There are shown below the provisions for the Bonus Plan and the Stock Option Plan before giving effect to the resulting reductions in income taxes.

1964	$116,000,000	1966	$114,000,000	1968	$111,000,000	1970	—	1972	$101,357,691
1965	130,000,000	1967	107,000,000	1969	110,000,000	1971	$90,000,000	1973	112,823,495

Condensed Consolidated Balance Sheet

General Motors Acceptance Corporation and Consolidated Subsidiaries

December 31, 1973 and 1972

Assets	1973	1972
Cash	$ 204,946,824	$ 220,520,716
Marketable Securities—short term—at cost	—	28,000,000
Notes and Accounts Receivable (including instalments maturing after one year: 1973—$4,678,807,737; 1972—$4,212,023,193; less unearned income: 1973—$784,428,384; 1972—$678,406,977 and reserves for losses: 1973—$126,803,446; 1972—$121,693,670)	13,748,055,565	11,766,336,782
Investment in Motors Insurance Corporation (wholly-owned nonconsolidated subsidiary carried at equity in net assets as shown by its books)	86,592,328	72,100,531
Unamortized Debt Expense	19,516,614	18,936,491
Other Assets	43,015,532	39,146,278
Total Assets	$14,102,126,863	$12,145,040,798

Liabilities, Reserves and Stockholder's Equity		
Notes, Loans and Debentures Payable Within One Year (less unamortized discount: 1973—$24,338,825; 1972—$6,788,512)	$ 6,198,390,324	$ 4,858,544,532
Accounts Payable, Accrued Liabilities and Reserves		
General Motors Corporation and affiliated companies (including noninterest bearing loan of $500,000,000 at December 31, 1973)	1,695,383,123	1,494,597,236
Dealers	115,006,639	114,101,116
United States and foreign income and other taxes	35,838,485	43,694,578
Interest	106,137,047	83,171,889
Other	45,651,180	36,013,987
Total Accounts Payable, Accrued Liabilities and Reserves	1,998,016,474	1,771,578,806
Notes, Loans and Debentures Payable After One Year (maturing prior to 1999—less unamortized discount: 1973—$10,890,113; 1972—$11,959,437)	3,952,330,172	3,751,914,865
Subordinated Indebtedness (maturing prior to 1993)	810,000,000	815,000,000
Stockholder's Equity		
Preferred stock, $100 par value (authorized and outstanding, 1,100,000 shares):		
6% cumulative	75,000,000	75,000,000
7¼% cumulative	35,000,000	35,000,000
Common stock, $100 par value (authorized and outstanding, December 31, 1973—5,150,000 shares; December 31, 1972—3,650,000 shares)	515,000,000	365,000,000

Net income retained for use in the business:	Year 1973	Year 1972		
Balance at beginning of the year	$473,002,595	$424,611,570		
Net income	88,424,798	96,428,525		
Total	561,427,393	521,040,095		
Cash dividends	43,037,500	48,037,500		
Balance at end of the year			518,389,893	473,002,595
Total Stockholder's Equity			1,143,389,893	948,002,595
Total Liabilities, Reserves and Stockholder's Equity			$14,102,126,863	$12,145,040,798

The above condensed balance sheet has been summarized from the financial statements appearing in the Annual Report of General Motors Acceptance Corporation as to which an unqualified opinion has been expressed by Haskins & Sells, independent public accountants.

Statistical Summary

Year	Net Sales	Net Income	Net Income as % of Sales	Dividends on Preferred Stock	Amount Earned on Common Stock		Dividends on Common Stock		Dividends on Preferred and Common Stocks as % of Net Income
					Total	Per Share*	Total	Per Share*	
1954	$ 9,823,526,291	$ 805,973,897	8.2%	$12,928,309	$ 793,045,588	$3.03	$ 436,507,196	$1.67	55.8%
1955	12,443,277,420	1,189,477,082	9.6	12,928,305	1,176,548,777	4.30	592,245,497	2.17	50.9
1956	10,796,442,575	847,396,102	7.8	12,928,302	834,467,800	3.02	552,853,282	2.00	66.8
1957	10,989,813,178	843,592,435	7.7	12,928,300	830,664,135	2.99	555,453,812	2.00	67.4
1958	9,521,965,629	633,628,076	6.7	12,928,298	620,699,778	2.22	558,940,800	2.00	90.3
1959	11,233,057,200	873,100,149	7.8	12,928,296	860,171,853	3.06	561,838,126	2.00	65.8
1960	12,735,999,681	959,042,489	7.5	12,928,293	946,114,196	3.35	564,190,599	2.00	60.2
1961	11,395,916,826	892,821,444	7.8	12,928,292	879,893,152	3.11	707,383,013	2.50	80.7
1962	14,640,240,799	1,459,077,450	10.0	12,928,290	1,446,149,160	5.10	850,465,125	3.00	59.2
1963	16,494,818,184	1,591,823,058	9.7	12,928,288	1,578,894,770	5.56	1,135,809,405	4.00	72.2
1964	16,997,044,468	1,734,781,555	10.2	12,928,286	1,721,853,269	6.05	1,266,306,261	4.45	73.7
1965	20,733,982,295	2,125,606,440	10.3	12,928,282	2,112,678,158	7.41	1,496,812,657	5.25	71.0
1966	20,208,505,041	1,793,391,691	8.9	12,928,278	1,780,463,413	6.24	1,298,106,848	4.55	73.1
1967	20,026,252,468	1,627,276,076	8.1	12,928,276	1,614,347,800	5.66	1,084,355,349	3.80	67.4
1968	22,755,402,947	1,731,914,777	7.6	12,928,273	1,718,986,504	6.02	1,227,446,007	4.30	71.6
1969	24,295,141,357	1,710,695,164	7.0	12,928,272	1,697,766,892	5.95	1,227,429,173	4.30	72.5
1970	18,752,353,515	609,086,848	3.2	12,928,273	596,158,575	2.09	971,027,351	3.40	161.5
1971	28,263,918,443	1,935,709,493	6.8	12,928,272	1,922,781,221	6.72	972,443,676	3.40	50.9
1972	30,435,231,414	2,162,806,765	7.1	12,928,270	2,149,878,495	7.51	1,273,066,301	4.45	59.5
1973	35,798,289,281	2,398,103,408	6.7	12,928,269	2,385,175,139	8.34	1,501,311,797	5.25	62.6

*In terms of present $1⅔ par value common stock

Factory Sales of Cars and Trucks, including export shipments

Year	Cars and Trucks Manufactured in the United States								
	Passenger Cars						Trucks and Coaches			Total United States
	Buick	Cadillac	Chevrolet	Oldsmobile	Pontiac	Total	Chevrolet	GMC	Total	
1964	484,137	154,991	2,118,647	511,848	693,743	3,963,366	524,501	110,123	634,624	4,597,990
1965	651,792	196,420	2,585,014	649,530	858,915	4,941,671	618,944	135,865	754,809	5,696,480
1966	582,098	205,009	2,201,882	594,906	864,797	4,448,692	620,322	126,370	746,692	5,195,384
1967	575,001	212,576	1,919,687	553,993	858,448	4,119,705	548,219	130,720	678,939	4,798,644
1968	649,789	211,389	2,144,622	636,594	938,921	4,581,315	679,771	149,234	829,005	5,410,320
1969	713,894	266,489	2,002,074	668,108	774,707	4,425,272	684,452	149,928	834,380	5,259,652
1970	460,721	152,696	1,499,537	440,230	424,056	2,977,240	491,954	121,870	613,824	3,591,064
1971	751,865	277,465	2,324,099	775,137	728,551	4,857,117	738,208	171,813	910,021	5,767,138
1972	688,665	277,454	2,301,604	807,372	703,029	4,778,124	766,840	195,476	962,316	5,740,440
1973	826,000	307,267	2,335,040	916,378	866,489	5,251,174	1,014,259	246,830	1,261,089	6,512,263

Note: Stockholders may obtain a copy of the Annual Report to the Securities and Exchange Commission on Form 10-K from General Motors after May 1, 1974, upon payment of $5.00. Requests should be addressed to: General Motors Corporation, Room 1-101, 3044 West Grand Boulevard, Detroit, Michigan 48202.

Net Income Retained for Use in the Business		Expenditures for Plant and Equipment (Excluding Special Tools)	Worldwide		At December 31			
					Common and Preferred Stockholders			
Total	Per Share*		Payrolls	Average Number of Employes	Number	Equity	Working Capital	Year
$356,538,392	$1.36	$ 754,650,239	$2,610,195,006	576,667	487,639	$ 3,339,070,208	$1,398,626,917	1954
584,303,280	2.13	608,121,546	3,127,145,514	624,011	565,408	4,255,055,724	2,088,174,944	1955
281,614,518	1.02	890,526,891	2,895,768,446	599,243	656,076	4,581,590,189	1,790,015,894	1956
275,210,323	.99	473,888,927	2,954,775,530	588,160	717,746	4,905,107,782	1,921,938,045	1957
61,758,978	.22	269,382,628	2,688,379,697	520,925	750,731	5,016,839,689	2,157,328,893	1958
298,333,727	1.06	319,940,202	3,083,759,866	557,218	786,744	5,371,011,318	2,624,108,800	1959
381,923,597	1.35	525,972,182	3,487,092,528	595,151	830,873	5,814,660,789	2,864,720,152	1960
172,510,139	.61	503,224,903	3,238,818,071	552,984	867,052	6,025,655,017	3,131,304,503	1961
595,684,035	2.10	645,113,381	3,894,873,691	604,718	1,059,225	6,650,971,621	3,610,075,503	1962
443,085,365	1.56	647,221,971	4,312,751,823	640,073	1,068,151	7,121,011,941	3,808,888,182	1963
455,547,008	1.60	929,588,476	4,592,481,476	660,977	1,186,885	7,599,015,311	3,739,647,071	1964
615,865,501	2.16	1,321,980,238	5,448,342,843	734,594	1,310,278	8,237,278,347	3,786,500,505	1965
482,356,565	1.69	1,188,054,246	5,559,741,677	745,425	1,417,955	8,726,102,975	3,709,147,192	1966
529,992,451	1.86	912,629,617	5,634,191,663	728,198	1,399,113	9,261,152,666	4,113,679,525	1967
491,540,497	1.72	860,189,501	6,540,142,678	757,231	1,371,795	9,756,809,763	4,390,235,128	1968
470,337,719	1.65	1,043,841,860	6,928,279,079	793,924	1,362,721	10,227,903,640	4,548,890,985	1969
(374,868,776)	(1.31)	1,134,164,761	6,259,840,549	695,796	1,357,604	9,853,770,622	3,267,590,973	1970
950,337,545	3.32	1,012,968,050	8,015,071,514	773,352	1,315,171	10,805,237,292	4,530,387,297	1971
876,812,194	3.06	940,037,584	8,668,223,736	759,543	1,284,825	11,682,879,023	5,564,774,932	1972
883,863,342	3.09	1,163,421,452	10,308,510,307	810,920	1,305,998	12,566,776,627	6,196,851,175	1973

Cars and Trucks Manufactured Outside the United States									
	Overseas Plants						Total Canada and Overseas	Total Sales all Sources	Year
Canadian Plants	Australia	Brazil	England	Germany	All Other	Total			
293,367	170,212	13,232	342,873	678,278	18,526	1,223,121	1,516,488	6,114,478	1964
418,527	151,514	11,624	330,983	636,503	32,500	1,163,124	1,581,651	7,278,131	1965
356,407	154,584	15,923	275,383	653,421	66,236	1,165,547	1,521,954	6,717,338	1966
385,827	145,067	17,086	290,706	560,239	73,783	1,086,881	1,472,708	6,271,352	1967
423,579	168,363	24,894	329,047	654,584	76,127	1,253,015	1,676,594	7,086,914	1968
501,134	174,476	52,015	285,574	802,463	84,212	1,398,740	1,899,874	7,159,526	1969
290,927	189,565	70,112	269,797	807,074	89,954	1,426,502	1,717,429	5,308,493	1970
508,665	187,469	82,432	331,186	824,354	77,981	1,503,422	2,012,087	7,779,225	1971
459,128	189,009	102,400	272,766	904,430	122,352	1,590,957	2,050,085	7,790,525	1972
579,808	200,042	143,163	258,721	845,303	144,500*	1,591,729	2,171,537	8,683,800	1973

*In 1973, includes 29,589 units for Argentina, 34,674 units for Mexico, 37,482 units for South Africa and 42,755 units manufactured by Isuzu Motors Limited and marketed by General Motors

Board of Directors

Stephen D. Bechtel, Jr.
Chairman,
The Bechtel Group of Companies
Director—4 Years

Eugene N. Beesley
President,
Lilly Endowment, Inc.
Director—9 Years

Harllee Branch, Jr.
Former Chairman of the Board,
The Southern Company
Director—9 Years

Catherine B. Cleary
President,
First Wisconsin Trust Company
Director—1 Year

Edward N. Cole
President and
Chief Operating Officer
Director—12 Years

John T. Connor
Chairman of the Board,
Allied Chemical Corporation
Director—8 Years

Frederic G. Donner
Former Chairman,
Board of Directors
Director—32 Years

Elliott M. Estes
Executive Vice President
Director—1 Year

Walter A. Fallon
President,
Eastman Kodak Company
Director—1 Year

Charles T. Fisher, III
President,
National Bank of Detroit
Director—2 Years

Richard C. Gerstenberg
Chairman, Board of Directors
and Chief Executive Officer
Director—6 Years

Harry Heltzer
Chairman of the Board,
Minnesota Mining and
Manufacturing Company
Director—1 Year

James R. Killian, Jr.
Honorary Chairman of the Corporation, Massachusetts Institute of Technology
Director—14 Years

W. Earle McLaughlin
Chairman and President, The Royal Bank of Canada
Director—7 Years

Thomas A. Murphy
Vice Chairman, Board of Directors
Director—2 Years

Gerald A. Sivage
Former President, Marshall Field & Company
Director—4 Years

Richard L. Terrell
Executive Vice President
Director—1 Year

Oscar A. Lundin
Executive Vice President
Director—4 Years

James M. Roche
Former Chairman, Board of Directors
Director—11 Years

Charles H. Townes
Professor, University of California
Joined Board in 1973

Howard J. Morgens
Chairman of the Board, The Procter & Gamble Company
Director—11 Years

Leon H. Sullivan
Pastor, Zion Baptist Church of Philadelphia
Director—3 Years

John A. Mayer
Chairman of the Board, Mellon Bank N.A.
Director—5 Years

George Russell
Former Vice Chairman, Board of Directors
Director—18 Years

Officers

Richard C. Gerstenberg
Chairman
Service—42 Years

Thomas A. Murphy
Vice Chairman
Service—36 Years

Edward N. Cole
President
Service—43 Years

Executive Vice Presidents

Elliott M. Estes
Operations Staff
Service—39 Years

Oscar A. Lundin
Financial, Industry-Government Relations and Public Relations Staffs
Service—40 Years

Richard L. Terrell
Car and Truck and Body and Assembly Divisions Groups
Service—36 Years

Group Vice Presidents

Reuben R. Jensen
Overseas Operations
Service—28 Years

Wallace E. Wilson
Automotive Components and Nonautomotive and Defense Groups
Service—36 Years

Vice Presidents and Group Executives

Joseph E. Godfrey
Body and Assembly Divisions Group
Service—37 Years

Howard H. Kehrl
Car and Truck Group
Service—26 Years

Frank O. Riley
Automotive Components Group
Service—38 Years

Roger B. Smith
Nonautomotive and Defense Group
Service—25 Years

Vice Presidents

Harold W. Campbell
General Manager
Frigidaire Division
Service—40 Years

Martin J. Caserio
General Manager
Pontiac Motor Division
Service—36 Years

Paul F. Chenea
Research Laboratories
Service—7 Years

David C. Collier
President, General Manager and Chief Executive Officer
General Motors of Canada Limited
Service—16 Years

Robert J. Cook
General Manager
Oldsmobile Division
Service—33 Years

Robert W. Decker
General Manager
Fisher Body Division
Service—32 Years

Anthony G. De Lorenzo
Public Relations Staff
Service—25 Years

George R. Elges
General Manager
Buick Motor Division
Service—32 Years

Stephen H. Fuller
Personnel Administration and Development Staff
Service—2 Years

Harlow W. Gage
General Manager
General Motors Overseas Operations Division
Service—40 Years

Charles Katko
General Manager
GM Assembly Division
Service—30 Years

Robert L. Kessler
Manufacturing Staff
Service—38 Years

James E. Knott
General Manager
Detroit Diesel Allison Division
Service—33 Years

Robert D. Lund
General Manager
Cadillac Motor Car Division
Service—28 Years

Robert F. Magill
Industry-Government Relations Staff
Service—19 Years

Alex C. Mair
General Manager
GMC Truck & Coach Division
Service—34 Years

Ross L. Malone
General Counsel
Service—7 Years

F. James McDonald
General Manager
Chevrolet Motor Division
Service—33 Years

William L. Mitchell
Design Staff
Service—34 Years

George B. Morris, Jr.
Industrial Relations Staff
Service—33 Years

Charles J. Scanlon
Pension Fund Investment Coordinator
Service—4 Years

Kenneth N. Scott
Special Assistant to Executive Vice President, Car and Truck and Body and Assembly Divisions Groups
Service—38 Years

Harold L. Smith, Jr.
General Manager
Electro-Motive Division
Service—28 Years

Ernest S. Starkman
Environmental Activities Staff
Service—3 Years

Henry W. Welch
Financial Staff
Service—40 Years

Frank J. Winchell
Engineering Staff
Service—34 Years

Mack W. Worden
Marketing Staff
Service—28 Years

Staff Officers

F. Alan Smith
Treasurer
Service—18 Years

Archie M. Long
Comptroller
Service—23 Years

Calvert Thomas
Secretary
Service—27 Years

Committees

Finance

Richard C. Gerstenberg
Chairman
Stephen D. Bechtel, Jr.
Eugene N. Beesley
Edward N. Cole
John T. Connor
Frederic G. Donner
Oscar A. Lundin
John A. Mayer
Howard J. Morgens
Thomas A. Murphy
James M. Roche
George Russell

Executive

Edward N. Cole
Chairman
Elliott M. Estes
Richard C. Gerstenberg
Oscar A. Lundin
Thomas A. Murphy
Richard L. Terrell

Audit

Charles T. Fisher, III
Chairman
Harllee Branch, Jr.
Walter A. Fallon
W. Earle McLaughlin
Leon H. Sullivan

Public Policy

John A. Mayer
Chairman
Catherine B. Cleary
John T. Connor
Harry Heltzer
James R. Killian, Jr.
George Russell
Gerald A. Sivage
Charles H. Townes

Bonus and Salary

Eugene N. Beesley
Chairman
Stephen D. Bechtel, Jr.
Frederic G. Donner
Howard J. Morgens
James M. Roche

Nominating

John T. Connor
Chairman
Stephen D. Bechtel, Jr.
Eugene N. Beesley
John A. Mayer
Howard J. Morgens

Administration

Edward N. Cole
Chairman
Martin J. Caserio
David C. Collier
Robert J. Cook
Robert W. Decker
George R. Elges
Elliott M. Estes
Harlow W. Gage
Richard C. Gerstenberg
Joseph E. Godfrey
Reuben R. Jensen
Charles Katko
Howard H. Kehrl
Robert D. Lund
Oscar A. Lundin
Alex C. Mair
F. James McDonald
Thomas A. Murphy
Frank O. Riley
Kenneth N. Scott
Roger B. Smith
Richard L. Terrell
Henry W. Welch
Wallace E. Wilson

General Managers

Car, Truck, Body and Assembly Divisions

Buick Motor Division
Flint, Michigan

G. R. Elges,
General Manager
Service—32 years

Buick passenger cars; U.S. distribution of Opel passenger cars

Cadillac Motor Car Division
Detroit, Michigan

R. D. Lund,
General Manager
Service—28 years

Cadillac passenger cars

Chevrolet Motor Division
Detroit, Michigan
(Manufacturing or assembly operations in 13 cities)

F. J. McDonald,
General Manager
Service—33 years

Chevrolet passenger cars and trucks

Fisher Body Division
Warren, Michigan
(Plants in 22 cities)

R. W. Decker,
General Manager
Service—32 years

Trim, metal and hardware fabricating and assembly of Fisher bodies

GM Assembly Division
Warren, Michigan
(Plants in 19 cities)

C. Katko,
General Manager
Service—30 years

Assembly of Chevrolet, Pontiac, Oldsmobile, Buick and Cadillac passenger cars and Chevrolet and GMC trucks

GMC Truck & Coach Division
Pontiac, Michigan

A. C. Mair,
General Manager
Service—34 years

GMC trucks, coaches and motor homes

Oldsmobile Division
Lansing, Michigan

R. J. Cook,
General Manager
Service—33 years

Oldsmobile passenger cars

Pontiac Motor Division
Pontiac, Michigan

M. J. Caserio,
General Manager
Service—36 years

Pontiac passenger cars

Service Parts Operations Divisions

Service Parts Operations
Detroit, Michigan

T. E. Darnton,
Executive in Charge
Service—35 years

Coordination of the supply, distribution, and marketing of car and truck service parts

General Motors Parts Division
Flint, Michigan

L. G. Kalush,
General Manager
Service—26 years

Distribution of parts for Chevrolet, Pontiac, Oldsmobile, Buick, Opel and Cadillac passenger cars and Chevrolet trucks

United Delco Division
Detroit, Michigan

M. C. Meehan,
General Manager
Service—33 years

Distribution of automotive service parts and equipment

Automotive Components Divisions

AC Spark Plug Division
Flint, Michigan

G. W. Chestnut,
General Manager
Service—41 years

Spark plugs; oil filters; instrument panels; fuel pumps; fuel filters; air cleaners; emission controls; cruise control systems

Central Foundry Division
Saginaw, Michigan
(Plants in 4 cities)

E. E. Braun,
General Manager
Service—44 years

Grey iron; malleable iron; Arma-Steel; nodular iron; aluminum and heat resistant alloy castings

Delco Electronics Division
Kokomo, Indiana
(Plants in 2 cities)

H. G. Riggs,
General Manager
Service—45 years

Auto radios; tape players; heater-air conditioning controls; semiconductor devices; integrated circuits; analog and digital systems; military electronics; inertial navigation and control systems and components

Delco Moraine Division
Dayton, Ohio

R. W. Truxell,
General Manager
Service—31 years

Automotive brake systems; engine bearings; powder metal products; automatic transmission components

Delco-Remy Division
Anderson, Indiana
(Plants in 5 cities)

P. W. House,
General Manager
Service—41 years

Starting, generating and ignition systems; switches; vacuum controls; batteries for passenger cars, trucks, coaches, farm tractors and off-highway equipment

Guide Lamp Division
Anderson, Indiana

C. W. Dobos,
General Manager
Service—39 years

Car, truck and tractor lamps; lighting controls; mirrors; finished die castings; molded plastic parts; stampings

Harrison Radiator Division
Lockport, New York
(Plants in 2 cities)

G. W. Wiegand,
General Manager
Service—34 years

Car and truck radiators, defrosters, heaters, thermostats and air conditioners; heat exchangers

Hydra-matic Division
Ypsilanti, Michigan

G. W. Griffith,
General Manager
Service—23 years

Hydra-matic automatic transmissions for cars and trucks

Inland Division
Dayton, Ohio

T. O. Mathues,
General Manager
Service—33 years

Weatherstrips; instrument panel pads; steering wheels; urethane seat pads; suspension ball joints; brake lining and hoses; flexible exterior trim; ice trays; engine and transmission mounts; air-conditioning hoses

New Departure-Hyatt Bearings Division
Sandusky, Ohio
(Plants in 3 cities)

P. B. Zeigler,
General Manager
Service—33 years

Ball, cylindrical, tapered and needle package bearings for automotive, aircraft and industrial uses; railroad journal boxes; sprag and roller clutches; transmission parts

Packard Electric Division
Warren, Ohio
(Plants in 2 cities)

B. T. Olson,
General Manager
Service—40 years

Automotive, appliance, marine and farm equipment wiring systems and components; fiber optics; magnet wire

Rochester Products Division
Rochester, New York

J. R. Wilson, Jr.,
General Manager
Service—31 years

Carburetors; diverter valves; emission control devices; cigarette lighters; locks; keys

Saginaw Steering Gear Division
Saginaw, Michigan

E. M. Ivey, Jr.,
General Manager
Service—33 years

Power, manual steering; anti-theft, energy-absorbing steering columns; driver-adjustable steering; air pumps; front-drive axles; steering linkages; suspension units; prop shafts; ball-bearing actuators

Nonautomotive and Defense Divisions

Delco Products Division
Dayton, Ohio
(Plants in 2 cities)

E. P. Czapor,
General Manager
Service—26 years

Shock absorbers; windshield wiper systems; energy-absorbing bumper devices; automotive electric motors and actuators; fan clutches; emission control devices; industrial and hermetic motors and generators

Detroit Diesel Allison Division
Detroit, Michigan
(Plants in 2 cities)

J. E. Knott,
General Manager
Service—33 years

Diesel engines and heavy-duty transmissions for trucks, construction, lumbering, mining and petroleum equipment plus marine and industrial applications; gas turbines for military and commercial aircraft applications; industrial gas turbines for generator sets, construction equipment, plus marine and transportation applications; locomotive parts; precision bearings

Diesel Equipment Division
Grand Rapids, Michigan

C. O. Donley,
General Manager
Service—33 years

Fuel injectors; hydraulic and mechanical valve lifters; jet fuel nozzles; cold formed precision parts

Electro-Motive Division
La Grange, Illinois
(Plants in 2 cities)

H. L. Smith, Jr.,
General Manager
Service—28 years

Diesel locomotives; utility power generating plants; large marine and industrial diesel engines

GM Transportation Systems Division
Warren, Michigan

D. J. Atwood,
General Manager
Service—14 years

Coordination and enlargement of GM's activities in urban and public transportation systems

TEREX Division
Hudson, Ohio
(Plants in 2 cities)

P. K. Hoglund,
General Manager
Service—25 years

TEREX crawler tractors, scrapers, front-end loaders and haulers

Household Appliance Division

Frigidaire Division
Dayton, Ohio

H. W. Campbell,
General Manager
Service—40 years

Refrigerators; freezers; washers; dryers; ranges; dishwashers; food waste disposers; automobile air conditioner compressors and room air conditioners; commercial ice cube makers; commercial washers; laundry centers; built-in wall ovens; cooking tops; microwave ovens; trash compactors

Finance and Insurance Units

General Motors Acceptance Corporation
New York, New York

J. O. Zimmerman,
President
Service—40 years

Wholesale and retail financing for dealers in GM passenger cars, trucks, buses and earthmoving equipment, and other GM products in the U.S., Canada and overseas

Motors Insurance Corporation
New York, New York

F. A. Mingle,
President
Service—40 years

Fire, theft, comprehensive and collision insurance for passenger cars and trucks in the U.S. and Canada

Motors Holding Division
Detroit, Michigan

William Harvey III,
General Manager
Service—25 years

Capital financing for retail dealers and distributors of GM products

Canadian Operations

General Motors of Canada Limited
Oshawa, Ontario
(Plants in 6 cities)

D. C. Collier,
President, General Manager and Chief Executive Officer
Service—16 years

Manufacture, assembly and distribution of GM cars, trucks, service parts and accessories; engines, transmissions, axles and other components; diesel locomotives; diesel engines; power generating plants; buses; TEREX products

Overseas Operations

General Motors Overseas Operations Division
New York, New York

H. W. Gage,
General Manager
Service—40 years

Manufacture, assembly and distribution of GM products outside the U.S. and Canada

A. A. Cunningham,
(General Motors Overseas Corporation)
General Director, European Operations
Service—26 years

W. H. Gussenhoven,
(General Motors Overseas Corporation)
General Director, Middle East-Africa Area
Service—39 years

J. F. Waters, Jr.,
(General Motors Overseas Corporation)
General Director, Latin American Operations
Service—22 years

M. E. Wilson,
(General Motors Overseas Corporation)
General Director, Australia, New Zealand and East Asian Operations
Service—28 years

Major Overseas Car and Truck Manufacturing Operations

Adam Opel AG
Ruesselsheim am Main,
Federal Republic of Germany
(Plants in 3 cities)

J. P. McCormack,
Managing Director
Service—25 years

Design and manufacture of Opel Kadett, Ascona, Manta, Rekord, Commodore, Admiral and Diplomat passenger cars, light commercial vehicles

General Motors do Brasil S.A.
Sao Caetano do Sul (Sao Paulo), Brazil
(Plants in 2 cities)

J. F. Beck,
Managing Director
Service—22 years

Manufacture of Chevrolet Chevette and Opala passenger cars, Chevrolet commercial vehicles and Frigidaire products; import of GM products

General Motors-Holden's Pty. Limited
Melbourne, Australia
(Plants in 6 cities)

Damon Martin, Jr.,
Managing Director
Service—27 years

Design and manufacture of Holden Torana, Monaro, Premier, Kingswood, Belmont and Statesman passenger cars, Holden light commercial vehicles; assembly of imported vehicles; import of GM products

Vauxhall Motors Limited
Luton, England
(Plants in 3 cities)

A. D. Rhea,
Managing Director
Service—26 years

Design and manufacture of Vauxhall Viva, Magnum, Firenza, Victor, Ventora and VX 4/90 passenger cars, Bedford commercial vehicles

Other Overseas Operations

Africa

General Motors South African (Pty.) Limited
Port Elizabeth, Republic of South Africa

Manufacture of Ranger, Chevrolet and Opel passenger cars, and diesel locomotives; assembly of imported vehicles; import of GM products

General Motors Zaire S.A.R.L.
Kinshasa, Zaire

Assembly of imported vehicles; import of GM products

Asia

General Motors Malaysia S.B.
Johore Bahru, Malaysia

Assembly of imported vehicles

General Motors Overseas Distribution Corporation Regional Parts Distribution Center
Singapore

Parts distribution

GM Philippines Manufacturing Corporation
Alabang (Rizal), Philippines

Manufacture of automotive components

General Motors Thailand Limited
Bangkok, Thailand

Import of GM products

Europe

General Motors Austria Ges.m.b.H.
Vienna, Austria

Import of GM products

General Motors Continental
Antwerp, Belgium;
Rotterdam, Netherlands

Assembly of imported vehicles; import of GM products

General Motors Deutschland GmbH
Wiesbaden, Federal Republic of Germany

Import of GM products

General Motors France
Gennevilliers (Seine), France

Manufacture of automotive components; import of GM products

General Motors GmbH
Berlin, Federal Republic of Germany

Manufacture of engine bearings

General Motors International A/S
Copenhagen, Denmark

Assembly of imported vehicles; import of GM products

General Motors Italia S.p.A.
Rome, Italy

Import of GM products

General Motors Limited
Dunstable, England
(Plants in 5 cities)

Manufacture of Frigidaire products and automotive components; import of GM products

General Motors Luxembourg S.A.
Bascharage, Luxembourg

Manufacture of TEREX off-highway earthmoving equipment

General Motors Nordiska A.B.
Stockholm, Sweden

Import of GM products

General Motors Norge A/S
Lillestrom (Oslo), Norway

Import of GM products

General Motors de Portugal, Limitada
Lisbon, Portugal
(Plants in 2 cities)

Assembly of imported vehicles; import of GM products

General Motors Scotland Limited
Motherwell, Scotland
(Plants in 2 cities)

Manufacture of TEREX off-highway earthmoving equipment

General Motors Strasbourg S.A.
Strasbourg, France

Manufacture of automatic transmissions

General Motors Suisse S.A.
Bienne, Switzerland

Assembly of imported vehicles; import of GM products

Suomen General Motors Oy.
Helsinki, Finland

Import of GM products

Latin America

General Motors Argentina S.A.
San Martin (Buenos Aires) Argentina
(Plants in 2 cities)

Manufacture of Chevrolet passenger cars and Chevrolet commercial vehicles; import of GM products

General Motors Interamerica Corporation,
Argentina Branch
San Martin (Buenos Aires), Argentina

Sale of locomotives and coordination of their manufacture

GM Locomotivas Ltda.
Sao Caetano do Sul (Sao Paulo), Brazil

Manufacture of locomotives and locomotive components

General Motors de Mexico, S.A. de C.V.
Mexico City, Mexico
(Plants in 2 cities)

Manufacture of Chevrolet passenger cars and Chevrolet commercial vehicles; import of GM products

General Motors TEREX do Brasil S.A.
Belo Horizonte, Brazil

Manufacture of TEREX off-highway earthmoving equipment

General Motors Uruguaya S.A.
Montevideo, Uruguay

Assembly of imported vehicles; import of GM products

General Motors de Venezuela, C.A.
Caracas, Venezuela

Assembly of imported vehicles; import of GM products

New Zealand

General Motors New Zealand Limited
Wellington, New Zealand
(Plants in 2 cities)

Assembly of imported vehicles; manufacture of Frigidaire products; import of GM products

United States

General Motors Interamerica Corporation
New York, New York

Distribution of GM products in western hemisphere areas not served by plants or warehouses

General Motors Overseas Corporation
New York, New York

Management services

General Motors Overseas Distribution Corporation
New York, New York

Distribution of GM products in overseas areas not served by plants or warehouses of other operations

Associated Companies

Isuzu Motors Limited
Tokyo, Japan (34.2% owned)

Design and manufacture of Isuzu 117, Bellet and Florian passenger cars, Isuzu commercial vehicles, engines for marine and industrial applications

Bangchan General Assembly Company Limited
Bangkok, Thailand (49% owned)

Assembly of imported vehicles

GM Allison Japan Limited
Tokyo, Japan (50% owned)

Import of gas turbine engines and heavy-duty automatic transmissions

General Motors Iran Limited
Tehran, Iran (45% owned)

Assembly of imported vehicles, manufacture of automotive components

General Motors Korea Company, Ltd.
Seoul, Korea (50% owned)

Assembly of imported vehicles

General Motors Philippines, Inc.
Manila, Philippines (60% owned)

Assembly of imported vehicles

DESIGN: ARNOLD SAKS, INC.
MAJOR PHOTOGRAPHY: BURT GLINN, MAGNUM
PRINTED IN USA


GT
FULL FLOW
AC
Oldsmobile
Cadillac
Oldsmobile
GMC
BODY BY FISHER
Delco
ENERGIZER
OPEL
BUICK
CHEVROLET
Cadillac
Grand Prix
BY PONTIAC
DELCO DS-501
DELCO DS-501
MOTOR DIVISION CHEVROLET
AC

General Motors
Corporation

Detroit
Michigan 48202

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GENERAL MOTORS CORPORATION

1973 REPORT ON

PROGRESS IN AREAS OF PUBLIC CONCERN

GM TECHNICAL CENTER • WARREN, MICHIGAN

February 8, 1973

GENERAL MOTORS CORPORATION
PROGRESS IN AREAS OF PUBLIC CONCERN

On February 8, General Motors held a conference at the GM Technical Center in Warren, Michigan, to report its progress in several areas of public concern. A number of institutional GM stockholders, such as universities and foundations, were represented at this conference, as well as a number of other individuals.

The conference had a two-fold purpose: to explain what we are doing, and to elicit appraisals of our efforts as well as suggestions to help us further our progress.

We thought you would be interested in the report of this conference. The conference highlighted not only GM's progress in many areas, but also noted some problems that remain unresolved. A long hard look was taken at the cost of further progress in light of the benefits that might be obtained.

We learned a great deal of what some of our stockholders are thinking from the conference. We send this report to you in the hope that you, too, will share your views with us.

Chairman

PRESENTATIONS

INTRODUCTORY REMARKS—THERE IS NO STATUS QUO

Edward N. Cole

EDWARD N. COLE, *President and Chief Operating Officer of General Motors and Chairman of its Executive and Administration Committees, joined GM in 1930 as a General Motors Institute student sponsored by the Cadillac Motor Car Division. Because of his talents, he was taken from GMI before graduation by Cadillac and assigned to a special engineering project. (He was granted a work-delayed degree from GMI in 1952.) He progressed through various engineering positions at Cadillac, becoming Chief Engineer in 1946, Works Manager in 1950, and Manager of Cadillac's Cleveland Tank Plant the following year.*

In 1952, Mr. Cole was named Chief Engineer of Chevrolet Motor Division and four years later was appointed General Manager of Chevrolet and Vice President of General Motors. In 1961 he became Group Executive in charge of the Car and Truck Divisions and was elected a member of GM's Board of Directors. He was elected an Executive Vice President in 1965 and placed in charge of all GM Staff activities. He was serving in that position when elected to the presidency in 1967. Mr. Cole serves as a member of the Finance Committee in addition to being a member of GM's other top policy-making Committees.

Mr. Cole is a member of a number of business, professional, and civic organizations and is current chairman of the National Industrial Pollution Control Automotive Sub-Council of the U.S. Department of Commerce.

You represent an important stockholder and thought leader segment with above average interest in our company, its products and its relationship to a changing society. We felt that you would not only have an interest in problems but also in their practical solution . . . that you would not only want to know what we *are* doing, but also what we *plan* to do . . . and that you would not only want to meet management, but also know management's philosophy and objectives.

These were our considerations in planning this Conference. We hope you find it informative and stimulating.

Most of you represent institutional investors—banks, educational institutions, foundations, mutual funds and insurance companies. In addition, there are a number of religious organizations represented; and, for the first time, we have added three other categories—brokerage houses, investment bankers and student leaders.

When we made up the invitation lists, we felt that you and the organizations you represent would have a special interest. After getting acquainted with you, we are more convinced than ever that we should have a mutually profitable day. Both the setting of the Conference and the format of the presentations are an effort to relate closely to your interests.

Our format concentrates most of the technical information in the morning, and the management and people-oriented programs in the afternoon. Both in the morning and the afternoon you will be given opportunities to ask questions—and we urge you to do so.

From questions raised at our Annual Stockholders' meetings and through our correspondence, we know many of you want to know more about GM employment practices in South Africa. As you came in this morning, you were given the booklet "General Motors and South Africa." This is a reprint of a talk given by Mr. E. M. Estes, GM Executive Vice President*. In the afternoon, Mr. Thomas A. Murphy, GM Vice Chairman, will have something further to say on the subject.

For those of you who have not visited our Technical Center before, the Conference location should be of interest. It is more than a complex of technical and administrative buildings. Specifically, it covers about half a square mile and houses more than 6,000 employes, most of them technical and creative personnel. Our speakers this morning are either Technical Center Staff executives or project leaders. There are some who would contend that my native element is also the Technical Center—that I spend more time here than in the General Motors Building—and I wouldn't argue. It is a stimulating and creative facility—staffed with problem-solving, forward-planning men and women.

More significant than the facilities themselves

**The complete text of Mr. Estes' presentation is reprinted on pages 90-96.*

is the management philosophy they reflect.

Some of us have emphasized that there is no status quo and that there must not be any status quo in General Motors. The Technical Center proves the point. It was dedicated in 1956, but it has never been finished and probably never will be. A construction project is always underway—either on the drawing boards or in the building stage.

The buildings themselves identify management priorities. Recently, the Environmental Activities Building was completed to more adequately house our two-year old Staff of the same name. Currently, we are constructing a new emissions laboratory for the Engineering Staff, and the Research Laboratories' Computer Building is being expanded.

Several other construction projects are approved but not yet started. These include added facilities for the expanding Research Laboratories, and a wind tunnel to study aerodynamics and ways to reduce wind noise and wind resistance for vehicles.

The continuous construction reflects corporate growth, but even more importantly, it reflects the thinking of the corporate mind and its open-mindedness to new ideas and new applications. It also reflects a determination to keep General Motors on the leading edge of all technology important to its future.

We recognize fully the changing nature of society, the rapid expansion of knowledge, the limitation of natural resources, and the concerns for the environment. All of these factors are a part of the Technical Center . . . and its role in new plant facilities and the development of new manufacturing processes and new products.

In a very real sense, the future is the assignment of each of the Staffs located here—Design, Engineering, Environmental Activities, Manufacturing, and Research.

Initially, the Technical Center was heavily oriented to customer and market needs. Product appearance, performance, comfort and convenience were paramount. In addition, other Technical Center activities emphasized production efficiencies, new materials, and facilities.

All of these areas are still essential in the automobile industry if we are to continue to provide outstanding product value by controlling costs and the price to customers, but there has been a change in recent years. New priorities are taking an increasing amount of manpower time and Corporation dollars. We are building cars with an eye to Washington as well as the customers on Main Street.

Mandated government standards for safety and emission control have become major assignments in manpower and money. For the 1972 and 1973 models, the energy-absorbing bumpers were a Design Staff priority. Emission-control developments involve several Staffs and many Divisions. In 1972, GM had the equivalent of 4,000 employes and an expenditure of about a quarter of a billion dollars committed to this project. Much of the research in plant pollution control is also done here. These expenditures are necessary to solve problems, but they also show a strong and significant trend—the movement of dollars and people to projects that are less profit related.

Air, liquid and solid waste and noise control all require investments and operating expenditures that are increasingly important from the standpoint of environment and natural resources. In 1972, the industrial pollution control expenditures for air and water were $58 million. For 1973, this is projected to be up to $80 million. These sums do not include the cost of operating and maintaining present facilities or funds earmarked for research into new pollution abatement systems.

There is another area of increasing Technical Center concentration and concern. This is manufacturing. For years, manufacturing has emphasized productivity, efficiency and quality. These continue to be important from the standpoint of profits, customer satisfaction and recalls and warranties —but manufacturing is faced with a new challenge.

As the hardware moves from research and development to tooling and manufacturing, General Motors is required to meet Federally-mandated standards on a mass production basis. Based upon present standards, 1975 and 1976 cars coming off the assembly line will have to match the emission-control effectiveness of hand-built, carefully-tuned prototype cars. It is the equivalent of putting 25,000 Chevrolets a day on the moon without a failure. But that is only the first chapter. Those same cars will have to be equally effective after being driven 50,000 miles or five years by a variety of drivers and under a wide range of operating, maintenance and climatic conditions. The assignment is the toughest in any industry,

calling for engineering and manufacturing breakthroughs on schedule.

It is a demand for not only product excellence but product perfection. This manufacturing objective is ultimately a Divisional responsibility, but initially is a technical Staff assignment.

One of the keys to achieving the Federal standards for 1975-76 is the averaging of the emissions of production vehicles in the administration of automotive emission regulations. Mr. R. C. Gerstenberg, Chairman of General Motors, spoke out strongly for this principle recently at the 1973 annual meeting of the Society of Automotive Engineers. The average emissions emitted to the air is of primary importance, not the emissions of the specific cars that may be either higher or lower than the standard.

Congress took this into consideration in setting the 1975 and 1976 requirements. The law requires at least a 90 percent reduction in emissions from the average emissions of 1970 and 1971 automobiles.

There is a variability from car-to-car and test-to-test that is inherent in mass production as well as present emission testing techniques. If it were determined that 99 percent of the cars at the end of the line must meet the existing Environmental Protection Agency standards, then the targets for experimental cars would need to be about one-half of the required grams per mile. You can see that this approach represents a severe tightening of the requirements beyond that specified in the law.

To guarantee that every car meets the standard would necessitate that every car be tested on the full Federal test. This 1975 test presently costs about $300, requires hours to complete, and would represent a very expensive auditing process. We have not found a simpler test that gives the same results as the full EPA test. Presently in California, we are auditing two percent of our production cars on the full Federal emission test. This audit shows with statistical confidence that 90 percent of the production automobiles comply with the California standards, and that the average vehicle is well within the standards. We feel that accepted statistical methods and inspection techniques should be used to assure that cars built in the assembly plant comply with the requirements of the law.

The interacting of many variables—each controlled within close tolerances—makes it impossible to obtain exactly the same emission levels for each of millions of production cars. Unnecessarily close limits add to cost without compensating value. Recently, GM announced that using current estimates available, based upon the technology as we see it today, the retail prices of cars equipped with the systems we are developing for 1975 and 1976 could be increased by $275 over today's prices. This would recover our cost, but would not include any markup for the manufacturer. It does not include any provision for return on our investment or, in the case of the customer, for additional maintenance, additional fuel, or catalyst replacement.

I would like to repeat.

So far, we have been working with laboratory systems and prototype hardware and our operating experience is over relatively few miles. This is a far cry from manufacturing 25,000 units a day that will be used for years over thousands of miles. We need more time for proper development and testing than the present time schedule permits.

To achieve Federally-mandated standards, we feel that the averaging principle should be used in end-of-the-line testing. The average of the cars produced should meet the Federal standards, not every single car. Averaging, plus necessary additional time, would not only make the achievement of Federal standards possible, but would also help to keep the cost to the customer down.

There is a popular misconception that all pollutants have the same health effects. This is just not true. The Third Annual Report of the President's Council on Environmental Quality recognized this recently. It said in part, "in most environmental areas, further research is necessary to add to our knowledge about effects . . . and research is underway to understand more fully the long-term health effects of air pollutants, so that the scientific basis for the standards can be improved." Dr. Bowditch will discuss this in more detail later.

The automobile industry has asked for a year's extension of the 1975 standards. This extension is within the prerogative of the EPA administrators. Our studies show that the additional time would make very little difference in air quality but could be a significant difference in cost to the customer.

The standards have been set in a somewhat arbitrary and inconsistent manner. For example, the ambient air quality limits which EPA has

established as a primary standard for carbon monoxide (not to be exceeded more than once per year) are 9 parts per million (ppm), averaged over eight hours. But, the Federal regulations permit up to 50 ppm for an undefined period of time in commercial aircraft cockpits.

There is still another aspect of the safety and emission problems that must be emphasized. All changes should be analyzed on a cost/benefit basis. Every benefit to the customer or the public has a corresponding cost to the car buyer, who ultimately must pay for product changes. Our objective is to provide the most in benefit for the minimum in cost.

For example, the achievement of 1973 emission standards—reductions of 80 percent in hydrocarbons, 69 percent in carbon monoxide, and 38 percent in oxides of nitrogen compared with the uncontrolled car of a decade ago—are relatively inexpensive. But to reduce emissions further to 97 percent for HC, 96 percent for CO, and 92 percent for NO_X can cost hundreds of dollars more per car with relatively little additional benefit to the public. The final few percentage points are not only the most difficult but the most expensive.

A similar cost/benefit analysis can be made for energy-absorbing bumpers. Any saving in insurance premiums or reduced cost of car damage should be weighed against the additional cost of the bumper and the additional gasoline needed to move the cars made heavier by the new bumpers, supporting frame, and related equipment.

From a technical standpoint, there is no status quo at GM, but that is only half the story.

There is also no status quo in GM's relations with people—employes, shareholders, customers and the public.

General Motors is not preoccupied exclusively with technology, decimal points and cost/benefit ratios. GM men and women have always been considered its most important asset. This has been a cliche from the days of Alfred P. Sloan, but it is also a fact in 1973 to a greater degree than ever before.

There are changes in the work force, work attitudes and work goals. But in any year, we believe GM is not only a good place to work but a place to make a good living, not only a place to make quality products but also a place to make a worthwhile career and have an opportunity to advance. Our production facilities are also people facilities—and we intend that they should be of the highest quality.

A little over a year ago, GM organized a new Personnel Administration and Development Staff to concentrate on more effective motivation, development and utilization of all employes for their benefit and GM's. You will hear about some of their activities this afternoon.

General Motors has also been responsive to social changes outside the plant as well as in.

Some critics of contemporary life have spoken out against the emphasis on science and engineering—space projects, computer age and the so-called plastic society. Others have questioned the competitive enterprise system as a vehicle of social progress.

You will see and hear the GM answers to these questions today. Properly directed technology is not a villain but a problem solver—creating jobs, improving living conditions and providing national hope and personal opportunity. Private or competitive enterprise does not develop profit for a limited number of persons, but does provide opportunity and hope for many. Enlightened technology applied through competitive enterprise is a vehicle of social progress as well as corporate progress. This is the nature of a socially-aware corporation.

We believe strongly that the basic concepts of the corporation should not change: organizational philosophy, basic personnel principles, manufacturing standards, and marketing integrity.

But we are just as convinced that a company must be responsive to the technical, social, cultural and economic environment in which it operates. It must not get out of step with either its markets or its many people contacts.

This is management's responsibility: to determine the difference between change and progress; to set priorities for technology, people and dollars; and to adhere to principles and yet be responsive to the voices and needs of people.

AUTOMOTIVE SAFETY: OCCUPANT AND VEHICLE PROTECTION

Louis C. Lundstrom

LOUIS C. LUNDSTROM *began his career with General Motors as a test engineer at GM's Milford, Michigan, Proving Ground in 1939, shortly after receiving a B.S.M.E. and M.S. in Engineering from the University of Nebraska. In 1953 he became Assistant Director of the Proving Ground, and three years later was appointed Director.*

In 1965, Mr. Lundstrom was named Director of Automotive Safety Engineering, which then was part of the GM Engineering Staff's activities. In April 1971, Automotive Safety Engineering became part of the Environmental Activities Staff, with Mr. Lundstrom as Director. He presently directs and coordinates all automotive safety for GM and is responsible for test work at the Proving Ground affecting the future design of GM automobiles in regard to occupant safety. He also directs the GM program on safety standards and the liaison with the National Highway Traffic Safety Administration.

Mr. Lundstrom is an active member of the Society of Automotive Engineers' Research Executive Committee and the Motor Vehicle Manufacturers Association's Safety Research Committee. He has served as a member of the Engineering Advisory Board of the S.A.E., the executive committee of the Highway Research Board of the National Academy of Sciences —National Research Council, and as chairman of the Vehicle Safety Development Committee of the MVMA. In 1962, the University of Nebraska awarded Mr. Lundstrom an honorary Doctor of Engineering degree for his work in test engineering and highway safety.

All of us dream of a day when traffic might be so well controlled, drivers so skillful and sober, roads so well engineered, and vehicles so perfect that there are no more accidents. When we return to reality, however, we realize that accidents will not cease. Therefore, vehicle safety engineers must continue to improve the protection of vehicle occupants in case of accidents.

As we have said on many occasions, and explained so often through GM advertisements and press releases—today's cars are equipped with many safety advances that have contributed to a gradual decrease in the highway death rate. However, the continued growth of the country in terms of more drivers, more miles traveled, and more traffic challenges keep the total number of highway deaths about the same.

It is not unusual, then, to hear the cry, what additional improvements can we make in automobiles? What new safety standards can be written? What new research can be initiated?

These are valid questions, but they completely ignore existing potentials for decreasing the amount of auto fatalities, potentials that can be exploited immediately, this very day.

One is accident prevention by keeping the drinking driver off the road. The other is injury prevention, through use of existing belt restraints.

With regard to injury prevention, I can say, categorically, that the best possible way we can significantly reduce traffic deaths and injuries at this time is to institute mandatory belt restraint use legislation. The customer already has paid for this protection: a belt use law will ensure his benefiting from it. How much will that benefit be?

Belt Restraints—Today

Let's examine the traffic fatality picture as it exists in the real world and assess the value of 100 percent belt restraint usage.

In 1971, the last year for which we have published accident statistics, the National Safety Council estimated that 54,700 people died from motor vehicle accidents. Of this number, about 21,000—38 percent of the total—were either pedestrians, bicyclists, motorcyclists, or other accident fatalities that could not be helped by restraints of any kind.

This leaves a fatality population of roughly 34,000, or 62 percent to which mandatory belt usage could have been applied. If all cars involved in these fatal accidents had been equipped with proper lap and lap-shoulder belts, and they were being worn, the National Safety Council estimates that about 10,000 fewer fatalities would have occurred in 1971. But let's be realistic. Of the

10,000 we might save under optimum conditions, we would have to subtract some unknown number. These would be occupants in cars too old to be equipped with lap or lap-shoulder belts—therefore, a mandatory belt use law could not have helped them—along with others who would stubbornly refuse to wear their belts despite the law.

I realize a most optimistic potential of a 10,000 fatality reduction through belt restraints does not seem overly impressive, but maybe it is time we stopped expecting miracles, particularly from a single device. It will take an extra effort on everyone's part to reduce the deaths that take place on our roads, and that reduction will be gradual, not instantaneous.

Regardless, the best savings in fatalities we could achieve today in occupant protection would be that savings resulting from mandatory use of available restraints. Such a law has reduced fatalities and injuries in Australia. We know that the belt systems will not properly protect every person—large and small—to the same degree. But they do have one great advantage: they now are available in the vast majority of cars, and their further use would reduce fatalities and injuries. I know of nothing that can be as economical—belts already are paid for—or nothing that can be as immediately productive.

The Department of Transportation has recommended such legislation by states, but none have responded as yet by passing such a law. Perhaps you can be influential in pushing this legislation through. It's worth thinking about!

Belt Restraints—1974

The Safety Administration in Washington can-

1974 Lap-Shoulder Belt Restraint System

not change the 87 million cars now on the road, but they do hope that new requirements for 1974 and 1975 will force use of lap-shoulder belts in the 10 or so million cars that industry hopes to sell in each of these years. Of course, this will be accomplished through substantially added cost and possible added inconvenience to our customers.

The safety standard for 1974-75 requires the belt restraint to be coupled with the ignition. It must be designed so that the starter will remain inoperative until a specified sequence of operations is completed by the driver and front seat occu-

Restraint System and Ignition Interlock

pants. First, they must sit down on the seats, then buckle up the belt restraints, and finally turn the key in the ignition. If they turn the key before they buckle up, or take the belts, buckle them together and stuff them inside the seat behind them, the car will not start. A logic module built into the system acts as a tattletale. It senses whether the occupants performed the two tasks in the correct sequence and decides if the driver should be allowed to start the car. A warning light and buzzer go into action also if you remove the belts after you start the car and place it in forward gear.

This sounds like a rather nervy way to convince people that they should wear their belts, and that is precisely what the safety standard is intended to do. On the other hand, the new belts will be more comfortable to wear and easier to put on than the current system.

The shoulder belt, for example, although permanently fixed to the lap portion, will be attached at the roof by an inertia reel. This new device will allow the occupant to move his upper torso freely, especially to lean forward without hindrance. The

inertia reel only comes into play when it senses a sudden deceleration of the vehicle, then it immediately reacts to snub the belts, restraining the occupant.

A special guide loop on the outer corner of the head restraint will do two things for the convenience of the user: (1) It will help keep the upper part of the shoulder belt from being pulled

Inertia Reel Allows Freedom of Upper Torso Movement

Guide Loop Provides for User Convenience

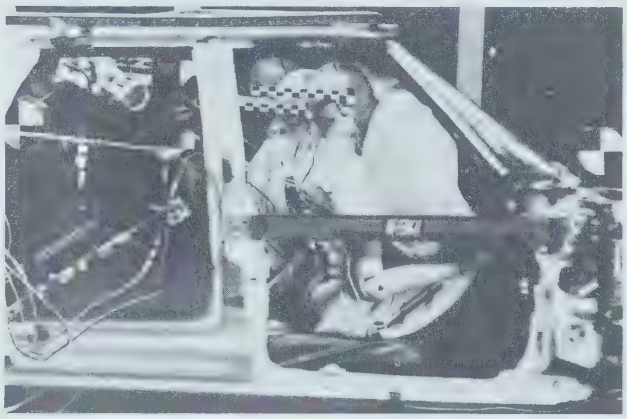
over across the neck, and (2) it will raise the belt out of the way of rear seat occupants.

These new belts have the features required for comfort and convenience, but the complicated electrical circuits for the starter interlock and warning buzzer may experience some field failures. The reliability of this new complicated system has not been adequately tested. The interlock will force many to use their belts, but even with the best of components, engineering analyses based on past experience tell us that a considerable number of cars may experience failures to start in the first year they are on the road.

The other obvious disadvantage is cost. The cost to the customer of cars equipped with this ignition interlock feature would be increased over today's cost by an estimated $50. This cost to the customer, which would not include any mark-up for the manufacturer, would amount to over ½ billion dollars on an annual basis. Because of its problems, General Motors has petitioned the Safety Administration to either modify or remove the requirement for the interlock. The new belt system strongly recommended by General Motors includes combined lap-shoulder belts with retractors, the new convenience items, warning buzzer and lights. This, we believe, would be the best 1974 proposal, from the standpoint of the consumer.

The Future: Air Cushion Restraints

Most of you know that General Motors is actively developing the Air Cushion Restraint



Air Cushion Under Test

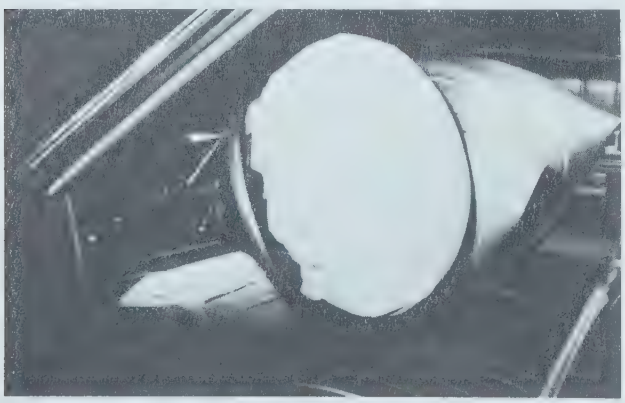
System. Much has been claimed for its potential, but potential doesn't save lives today. If everything proceeds on an optimistic schedule, it would be 1987—14 years from now—before virtually all cars on the road with lap and shoulder belt restraints are replaced with those having air cushions or other forms of passive restraints.

Just this week we produced the last of our 1,000 1973 Chevrolets equipped with air cushions for public and private fleet testing on everyday roads and in all driving conditions. At least 750 of these cars already are in the hands of drivers in various cities across the countryside. We have attempted to utilize high mileage drivers from public fleets so that the air cushion will get as much driving exposure as possible.

Air Cushion-Equipped Chevrolet for Public and Private Fleet Testing

Generally speaking, the drivers who have accepted these cars are pleased with them. A few, who habitually wore belt restraints, still feel uncomfortable without them. Later, we intend to remove about 30 of these vehicles from service and subject them to various kinds of simulated crash tests to which they might not be exposed in the field.

Assuming that our combined development and experience is favorable, in order to gain production experience GM is planning to offer the air cushion in 1974 as an extra cost option on the Buick Electra and Riviera, the Oldsmobile Ninety-Eight and Toronado, and most Cadillacs. Also, there will



Inflated Air Cushions

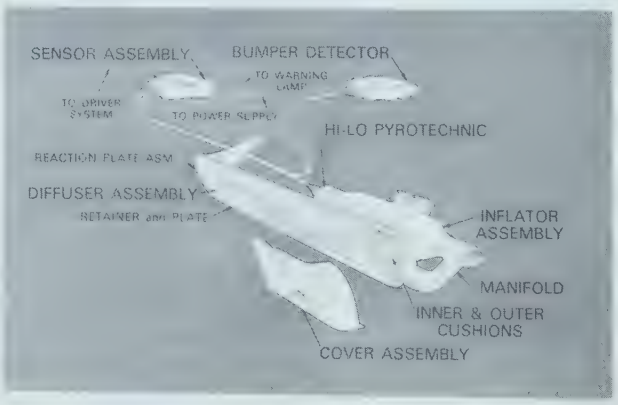
be a lap belt option available for those who would like to make use of both type restraints.

Update on Air Cushion Development

An updating on our air cushion development may be of interest. We now feel that we have had

Air Cushion Assembly In Field Test Car

sufficient laboratory and road testing of electrical components, like the sensor, to limit the possibility of it not firing in an accident, or firing inadvertently when not required.

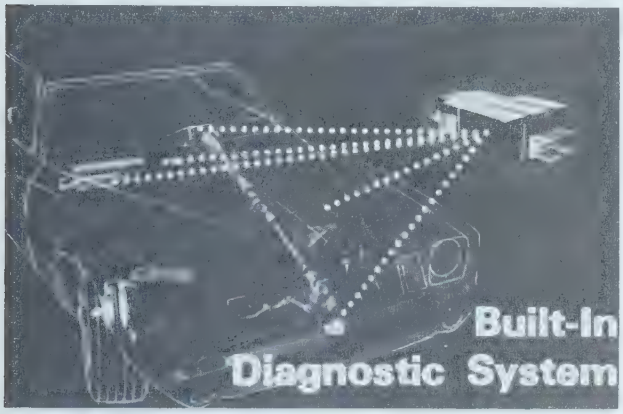


Bumper Detector and Electronic Sensor for Air Cushion System

The bumper detector and electronic sensor, key components that control the discriminatory and triggering actions of the air cushion system,

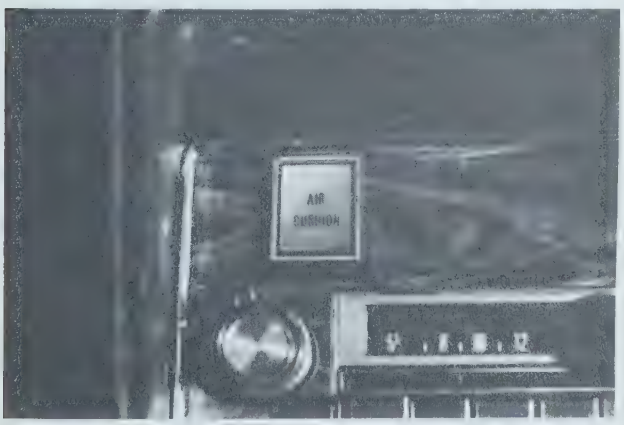
were developed by our Delco Electronics Division (which produced the Apollo Guidance Systems). Similar highly reliable components have been developed by other Divisions of General Motors: the passenger air cushion at Fisher Body; the driver air cushion at Oldsmobile and Inland; and a new energy-absorbing steering system at Saginaw Steering Gear Division.

I might add that the GM air cushion has a built-in diagnostic system that constantly monitors



Diagnostic System Monitors Readiness of Air Cushion

the readiness of its key parts. If the system detects malfunctions such as low pressure in the inflator, a faulty bumper switch or sensor, a disconnected line or any other occurrences that might keep the air cushion from being inflated at the proper time, it warns the driver by a red warning light. The diagnostic system makes it unnecessary for the car owner to have his air cushion repeatedly inspected to see if it is in working condition. The system even serves as an after-production line check; that is, if the system has not been installed correctly, the warning light will glow as soon as the vehicle is driven off the assembly line, and remain lit until corrective measures have been taken.



Air Cushion Warning Light System

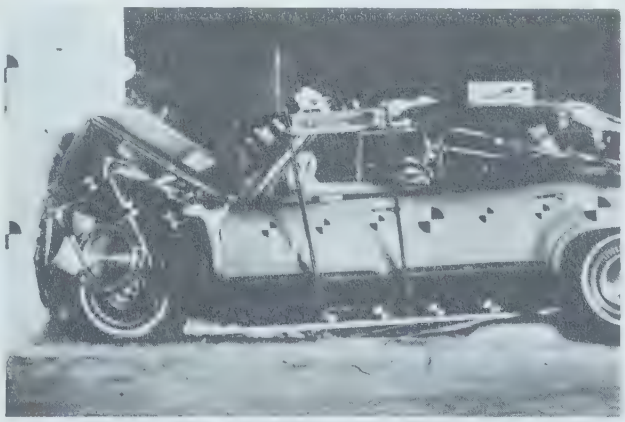
Human Volunteer Tests

This past September, human volunteers rode the impact sled at Holloman Air Force Base, New Mexico, restrained with the latest GM air cushion design. Even at abrupt stops from 30 mph, they

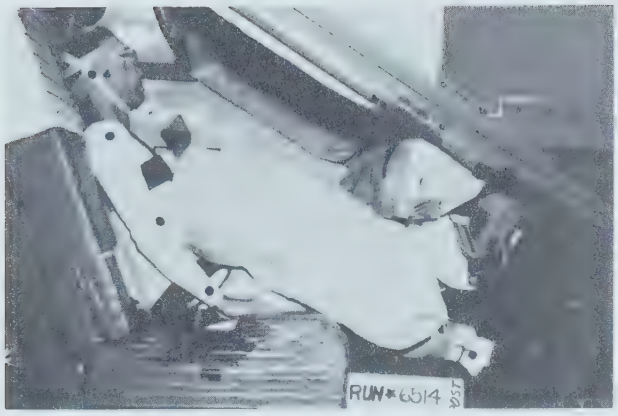
Air Cushion Test on Impact Sled Using Human Volunteers

emerged not much the worse for the experience. One of the volunteers, in fact, after completing his test, commented that the ride experience was less severe than those he and thousands of others had taken part in at the local State Fair the previous weekend. While test measures show this is not an accurate correlation, the subjective comparison made by the volunteer certainly is impressive.

The 30 mph impact sled test is like a 30 mph collision with a concrete wall. It is a severe stop. We were impressed by the ease with which these



30 mph Barrier Test



Human Volunteer at Completion of 1972 Air Cushion Impact Sled Test

young male human volunteers went through roughly a similar experience.

I should explain that the General Motors air cushion with which they were being restrained in this series of tests was considerably different from the one human volunteers were exposed to in the summer of 1971, when we were testing the original General Motors air cushion design. The results of those earlier tests told us that we must provide a softer bag inflation in order to reduce the rebound that the volunteers were experiencing at that time. This was done, and the current design of the air cushion system is a considerable improvement that limits the possibility of injury resulting from air cushion inflation. This is the kind of learning experience we need very much for new product development, a learning experience that takes time. We call it lead time.

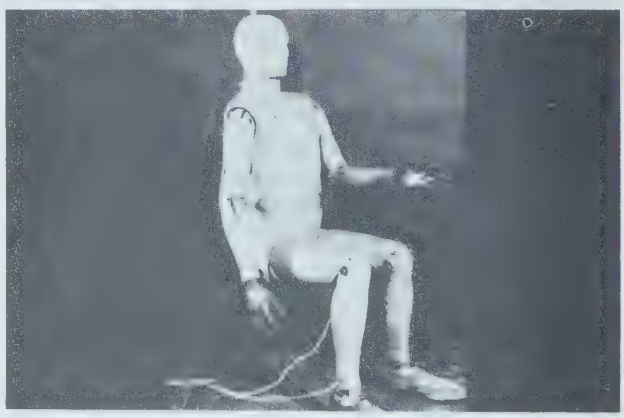
Test Dummies

The recent decision of the Sixth U.S. Circuit Court of Appeals on the 1976 Occupant Protection Requirements For Passive Restraints has had little effect upon our air cushion development.

Early Air Cushion Test With Human Volunteer

Let me expand on that. The court decision did rule that air cushion technology had been developed to a point where they could be installed in new vehicles. However, it also pointed out that the Motor Vehicle Safety Standard with regard to passive restraints, of which the air cushion is one, could not be put into force until the test procedures for the standard were clarified, and until the test devices, in this case the test dummy, could be defined in objective terms.

We found this to be a very interesting judgment on the part of the court, since we had called the Safety Administration's attention to the deficiency of current dummy models as far back as April, 1971. At that time we informed Washington that

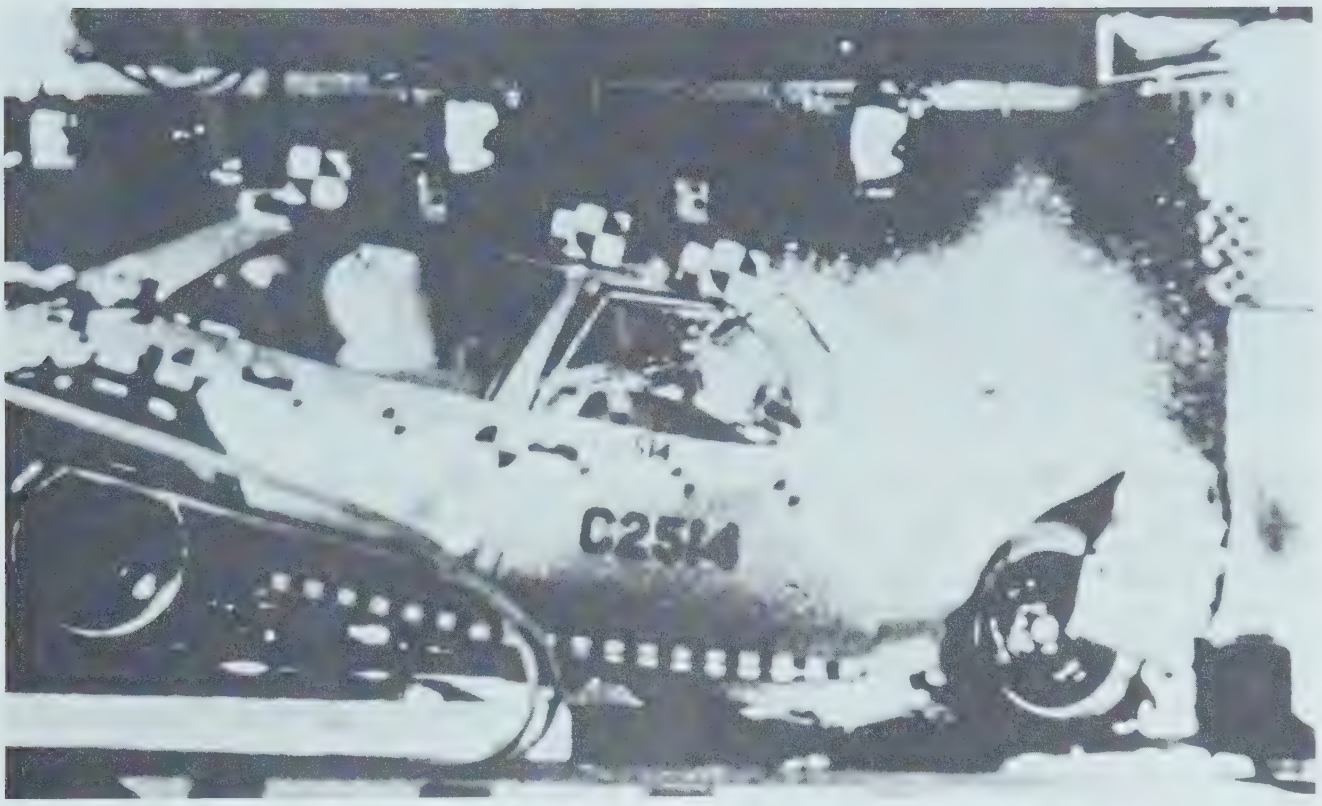


GM Hybrid Test Dummy

our own testing was being done with dummies that were a composite of what we considered the best parts of commercially available dummies. We called our dummy the Hybrid, but even he was far from adequate.

At this point, we do not know whether a satisfactory dummy can be designed or manufactured in sufficient time for the Safety Administration to reinstate its requirements for full passive restraints in 1976, as originally scheduled. Nonetheless, we are proceeding with our field trial plans on schedule.

We firmly believe that our development and test program has been accelerated to the maximum degree. Here again, the best test program is the one we are now starting with the 1,000 cars in actual customer service. We believe that with the present state of the art we should have more time



50 mph Barrier Impact of ESV

for development and particularly testing before installing this entirely new and complex system in all our cars now scheduled for introduction in 1975.

Experimental Safety Vehicle

Finally, I would like to add one more observation that has encouraged our development of safer cars. And this has had to do with work necessary to meet contract objectives in the Experimental Safety Vehicle program.

GM Experimental Safety Vehicle (ESV)

In the final 50 mph barrier impact test of our ESV car, conducted by the Government on November 11, 1972, the vehicle structure worked as we had planned. The air cushions fired successfully. But whether people could survive an impact like this in a similar vehicle in real life we do not know, and rather doubt. We still have much to learn about occupant restraints. Be that as it may, the ESV program did give us valuable experience in designing for added vehicle safety in future models.

1974 Bumpers

Exterior protection, or bumpers, although not directly involved in the task of protecting lives like the structure of the ESV car, still fall within the realm of safety and bear mention because of new Federal and state requirements for 1974.

Next year, rear bumpers must provide 5 mph barrier impact protection to safety components, as do front bumpers today. This is an increase from the 2.5 mph rear protection of current requirements. In addition, front and rear bumpers must be able to pass a series of pendulum impact

1974 Bumpers Will Provide Equal Front and Rear Protection

Pendulum Impact Test for Bumpers

tests that will have the effect of requiring bumper match among all passenger cars.

The 1974 standard will require wider bumper faces on almost every GM model, and there will be a large increase in the usage of Enersorbers produced by Delco Products Division. To obtain the necessary impact performance, the bumpers will become heavier. Their cost-benefit also still is questionable.

The preceding discussion on belt restraints, the air cushion, and bumpers brings us up-to-date on projected changes in both occupant and vehicle protection for next year. I think you will agree that the most interesting and important aspect of safety in the immediate future relates to customer acceptance of belt restraints and the optional air cushion.

But remember, your safety still lies in your hands.

Discussion Period

In response to a request for comment on a recent statement by Dr. Haddon of the Insurance Institute that there has not been too much progress made in the crash-worthiness of bumpers, Mr. Lundstrom replied that Federal standards require that new cars pass a 5 mph front and a 2½ mph rear barrier impact test without damage to the safety related components. Individual car manufacturers can build as far above that minimum level of protection as they desire. Mr. Lundstrom mentioned that in its lower cost, smaller model cars, GM has elected to work only slightly above that level to keep weight and price down, but on its larger series of cars GM has added extra strength, and Enersorbers, at some additional weight and cost, to be closer to a no-damage condition.

Mr. Lundstrom went on to say that some of Dr. Haddon's statements have, unfortunately, been misinterpreted. Mr. Lundstrom pointed out that data from the Insurance Institute, based on their own tests, showed that the 1973 Chevrolet went far beyond the Federal standard requirement, with no repair cost at a 5 mph front barrier test. Further, in 1972, Dr. Haddon had estimated $153 damage to a Chevrolet after a similar test, and in 1971 the estimate was $367. Mr. Lundstrom said that these results show that good progress has been made. Mr. Lundstrom then illustrated results of Dr. Haddon's tests of 2½ mph rear bumper impacts. The first test, of a 1972 model Chevrolet, showed damage of $112. In contrast, a

1973 model had damage estimated to be $12.

Next, Mr. Lundstrom showed a chart based on higher speed bumper impact tests run by Dr. Haddon. At a 10 mph barrier test, the damage costs dropped from $576 in 1972 to $281 in 1973. The reduction in damage at a 15 mph barrier test, although significant, was not as great because at this speed major structural damage to the car begins to occur. Mr. Lundstrom concluded by indicating that for the small size Vega, the bumper system had to be lighter and more economical. Although some damage does occur under barrier tests, the Vega still passes the Federal standard and does show significant improvement in bumper effectiveness over the 1972 model.

An individual, who mentioned he was a member of Dr. Haddon's Insurance Institute Board, indicated that Dr. Haddon had stated that there had been substantial improvement made in bumper effectiveness, but that there still was room for improvement. He further mentioned that Dr. Haddon had been somewhat disturbed over the press stories that played up the negatives of bumper design but did not stress the progress that had been made.

A question was asked if there would be any 1974 Chevrolets equipped with the Air Cushion Restraint System. Mr. Lundstrom replied that it was decided to put the optional air cushion system on certain 1974 model Buick, Oldsmobile and Cadillac cars for merchandising reasons.

Asked whether evidence showed that persons more interested in smaller size cars might also not be interested in paying for additional safety features, like an air cushion, Mr. Lundstrom replied that the air cushion restraint, to a considerable extent, represented a comfort and convenience device, as opposed to the lap and shoulder belt system. The person who buys a larger size car would presumably be more willing to put money into such a new comfort and convenience option. He went on to say that the air cushion system would hopefully be available on the smaller size models in due time.

Mr. Lundstrom also indicated that development work on the air cushion had to start someplace, and it first was begun in a full-size car like the Chevrolet. Further development work made it logical to first offer the system on similarly sized cars, providing experience with the fleet field tests is positive. Mr. Cole also commented that since only larger size car instrument panels were being re-designed for 1974, it was more logical to provide space for the air cushion in these panels. Mr. Cole also mentioned that he was confident the Safety Administration would amend the occupant protection standard, enabling GM to proceed with the 1974 phase of the air cushion restraint project.

In response to a question on how the air cushion compares to lap and shoulder belts in safety effectiveness, Mr. Lundstrom replied that the comparison must be based on the type of accident. The air cushion restraint hopefully will protect front seat passengers in the most severe type of accident —the frontal collision. Under this type of accident, it should be as good or better than the lap and shoulder belts. But for side impacts and roll-overs, the air cushion has not been developed to a point where we know that it would protect passengers. He said that the lap and shoulder belts help in lateral impacts, particularly in keeping people inside the car if the door opens or the side of the car is torn away. He concluded by saying that although the lap and shoulder belts would offer more protection in the lateral and roll-over type of accident, the air cushion would probably be better on the forward impact type of accident. However, field experience is still necessary to prove this.

In reply to a question on the feasibility of combining present belt structure (anchorages) with an inflatable belt, Mr. Lundstrom stated that an inflatable belt would increase the capability of an individual to tolerate the loads of a belt restraint. Mr. Lundstrom noted that the belt used today places a limit on the forces to which a body can be subjected. With an inflatable device, the contact area could be broadened and presumably it would permit the belt restraint to be more effective at a higher speed than is possible today. He emphasized that an inflatable belt would still have the same inconvenience factor as the present lap and shoulder belt systems.

In reply to a question asked about the detection of drunk drivers, Mr. Lundstrom said that GM continues to investigate devices that might prevent a drunk from starting his car. He mentioned that the Phystester developed by GM did work, but required some calibration to the person, since certain drunk individuals could pass the test and start their car. Mr. Lundstrom discussed GM's

present development which requires a driver to pass a simple pre-start test. This test involves a needle on the instrument panel which fluctuates back and forth. The driver is required to turn the steering wheel to keep the needle on center. If he cannot do this, the ignition is blocked out and the car will not start.

An individual asked if GM anticipated any Federal requirements on devices to detect drunk drivers. Mr. Lundstrom said that the Safety Administration had quite a few projects under consideration and is sponsoring research on their own to develop a system that will hopefully keep the drunk driver off the road.

CONTROL OF INDUSTRIAL AIR, WATER, AND NOISE POLLUTION

Gabriel N. Tiberio

GABRIEL N. TIBERIO, *Director of Plant and Environmental Engineering, Environmental Activities Staff, has been instrumental in helping establish many of the air and water pollution control standards and equipment used by GM in its plants throughout the country.*

Mr. Tiberio joined General Motors in 1951 as a plant layout engineer with the Rochester Products Division. In 1958 he was named assistant superintendent of utilities at Rochester Products, after serving in a number of engineering and supervisory positions.

In 1961, Mr. Tiberio was transferred to GM's Operations Staff as an engineer in the Manufacturing Staff's Plant Engineering Section. In this position, he specialized in industrial pollution control activities. He was named Director of Plant Engineering, Manufacturing Staff, in March 1971. He assumed his present position one month later when his operation became a part of the Environmental Activities Staff.

Mr. Tiberio received a Bachelor of Mechanical Engineering degree from the University of Rochester in 1950. His technical affiliations include memberships in the Engineering Society of Detroit and the Air Pollution Control Association. He currently is Chairman of the Environmental Quality Committee, Michigan State Chamber of Commerce.

Two years ago, I had the pleasure of speaking to some of you at a similar meeting held at the GM Proving Ground in Milford, Michigan. At that time we discussed two environmental issues that were of concern to us—air and water pollution control.

While air and water pollution still demand a great deal of our attention, they are only segments of what we refer to as total industrial environmental control.

General Motors operates 112 plants in the United States and an additional seven plants in Canada. All of these plants, with the combined support of many corporate Staffs, are involved in solving new and more complex problems associated with external environment, internal environment, energy systems, and the engineering requirements of the Occupational Safety and Health Act (OSHA). This morning I will give you an overview of our activity in each of the areas mentioned, and then we will focus on some specific problems and solutions that should be of interest.

External Environment

The external environmental programs are directed at the control of air pollution; water pollution; and solid, semi-liquid, and liquid waste disposal.

Our plants are continuing to modify and expand their pollution-control facilities, but we are also looking for methods to improve the reclamation and reuse of industrial water and the more efficient disposal of solid wastes, and we are developing technology that will enable us to burn coal in an environmentally acceptable manner.

Internal Environment

Internal environmental control deals with the engineering solutions to conditions affecting the health and comfort of our employes in the plant. In the past we have been concerned with noise, airborne contaminants, general plant ventilation and thermal control systems primarily from a health standpoint, and our plants have an outstanding record of accomplishment. Today these items are being extended to include comfort and aesthetic well-being—part of "humanizing" the work environment.

The future impact of internal environmental control will be as great as, if not greater than, we see today for air- and water-pollution control.

Energy Systems

Our energy systems engineers are involved with the installation of major electrical systems, powerhouse equipment selection, and utility contract negotiations. On a corporate level, we assist in fuel planning based on the availability, dependability and the economics of gas, oil and coal; and we are now trying to get a handle on the much discussed energy crisis and its short and long-term effects on our manufacturing operations. This group is also responsible for initiating an energy and utilities conservation program in all of our plants.

Maintenance and OSHA

The maintenance and OSHA program is concerned with the technical aspects of the Federal Occupational Safety and Health Act and with maintenance management, both as required by OSHA and as needed to keep our manufacturing equipment in the best operating condition.

The purpose of OSHA is "to provide a safe and healthful work place for every employe" through government standards for a myriad of items ranging from aisle lines to x-ray equipment.

To meet the provisions of OSHA, all our plants have formed committees, usually chaired by the Safety Director, to analyze the provisions of the law, to review the plant operations for any deficiencies, and to make corrections where required.

The Safety Activity of the Industrial Relations Staff is charged with the overall compliance position of GM relative to this law, and many other Staffs assist the plants in deriving the best engineering solutions for OSHA requirements.

Water-Pollution Control

Now for some specific programs. In water-pollution control, our plants have done an outstanding job of installing waste-treatment systems to abate water pollution. We now have on line 63 complex, integrated control systems capable of treating a variety of pollutants, 52 systems for specific wastes, and 40 control processes at plants that generate a minimal amount of waste water.

In addition to treatment facilities for the control of the normal liquid wastes generated by the manufacturing operations, GM last year initiated a "spill containment" program. This involves the installation of holding ponds, lagoons or dikes to contain on plant grounds the accidental discharge of pollutants that occasionally occurs in industrial operations.

Holding Lagoons

Waste treatment in our divisions means more than rendering a potential pollutant harmless—it also means resources recovery. Some of our plating plants have installed chromium and nickel recovery units, and many of our machining operations are "in the oil business."

Chromium and Nickel Recovery Unit

The Chevrolet Motor Division reclaims about nine million gallons of oil per year as a by-product of water-pollution control; Saginaw Steering Gear Division collects industrial waste water from six locations and recovers more than a million gallons of oil annually that is cleaned, re-refined and used again in the manufacturing operations.

Oldsmobile Division has a unique arrangement for the disposition of reclaimed low-quality oil. It provides a portion of the fuel required to generate electrical power in the City of Lansing by selling up to one million gallons of recovered oil a year to the nearby municipal utility.

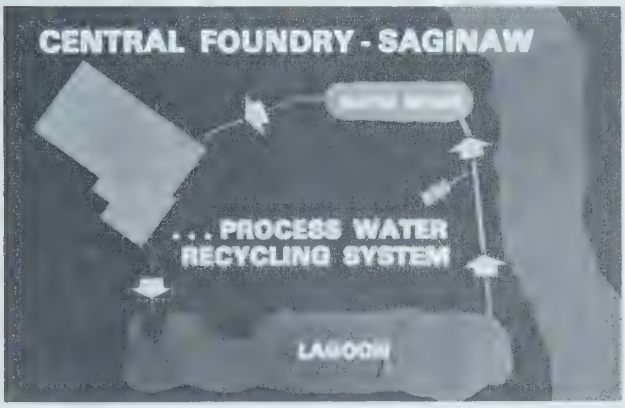
By today's water-pollution control standards, our plants are in good shape, but the national goal of "zero discharge" of pollutants by 1985 does not allow us to rest on our laurels. Although the "zero discharge" concept seems unrealistic at this time, we are investigating the possibility of a TWCS—Total Water Conservation System.

We have a project in the development stage that we think will enable us to purify waste water to a degree suitable for reuse in any plant process. Basically, the waste water is passed through sand filters for suspended solids removal, activated carbon towers for organics removal, and, finally,

through reverse osmosis units for the reduction of dissolved solids. This last step, the reduction of dissolved solids, is where the real life technology has to be developed. The final product water may be further purified by ozonation and recycled to various processes as make-up or as a coolant.

This approach is not to be confused with recirculating water systems now being used by the majority of our plants where the water is used for cooling purposes or for solids transport.

For example, the Central Foundry operation in Saginaw, Michigan, has been using a process water recycling system for several years. The cooling



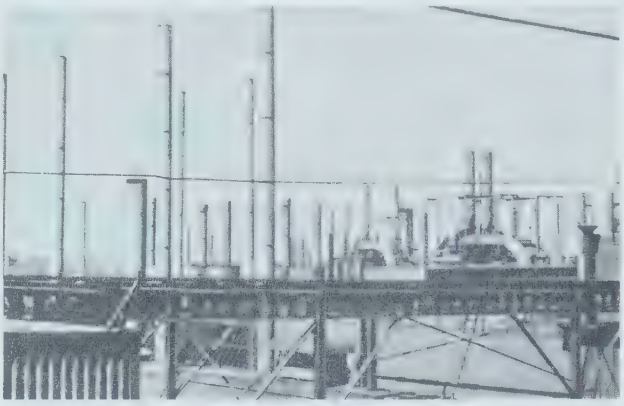
Closed Loop Process Water Recycling

water and water from the sand transport operations is pumped into large lagoons or settling basins where the foundry solids are settled out by gravity as a function of time. The "clean" water is then returned to process. This system removes only suspended solids and does not affect any organics or dissolved solids present in the water.

At the present time, we can reduce contaminant loadings in the water, we can reduce the volume of waste water discharged from the plant, but the closed loop or "zero discharge" is a long way from being an across-the-board reality.

Air-Pollution Control

In air-pollution control, our plants have made significant progress in reducing particulate or dust emissions from process or boiler stacks. Our foundry operations, that a few years back were considered to be one of the top air-pollution problems, are now within a few months of being under total control. The foundry emission-control engineers have their control programs or conversion projects on schedule, and our latest report indicates that by the 4th quarter of 1973 the skies above all our foundries will be clean and clear.

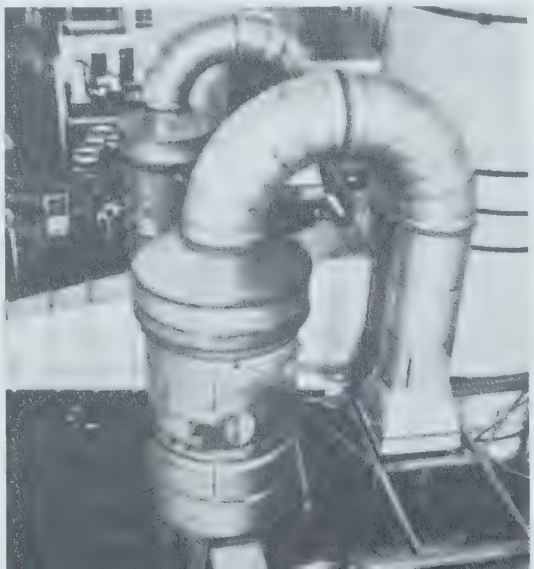


Foundry Roof Line

Although the smoke and dust emission codes for boiler plants are becoming much more restrictive, the technology is available to meet the new standards. However, many of the enacted limitations on the use of sulfur-bearing coal cannot be met with existing or proven control technology.

In line with our conviction that coal must be a base boiler fuel for generating steam in most parts of the country, and recognizing the limited supply of low-sulfur coal, GM started to investigate the feasibility of removing sulfur dioxide from the boiler flue gas back in 1968. The pilot program, initiated at what is now the GM Assembly Division plant in St. Louis, was a pioneering project and enabled us to obtain valuable data on the efficiencies of various systems. This resulted in what we call our first generation scrubber that used a

First Generation Scrubber for SO_2 Removal From Flue Gases



caustic solution to "wash" the sulfur dioxide from the flue gases. To complete the St. Louis story, that system was put into operation last November, and, as far as I have been able to determine, it's the first of its type to be installed on an industrial boiler.

In 1970, a regenerative, double-alkali SO_2 pilot study was also started at the Chevrolet plant in Cleveland, Ohio, to determine if the caustic could

SO_2 Removal System At Chevrolet-Cleveland

be regenerated and used back in the system to reduce both cost and water-pollution potential. This concept was proven to our satisfaction, and in 1972 we started construction on a full-scale system at the Chevrolet-Cleveland plant to prove total feasibility.

We have a high confidence factor in this project, but I want to stress that until we obtain more on-line operating experience, we cannot commit all of our plants to this approach.

We have made the technology gained from our experience on SO_2 removal available to many other industries, to the Department of the Interior, and to the Environmental Protection Agency. We think the GM engineers involved in these projects are making a significant contribution to the utilization of coal as an environmentally acceptable fuel.

Solid Waste Disposal

Solid waste disposal is another area that offers a challenge calling for innovative thinking, for it goes hand in hand with resources recovery. Resources recovery and conservation must be practiced not only for economic reasons, but also in recognition of a basic truth—we have but a finite supply of certain materials, and the depletion rate is a function of judicious use and recycling.

In addition to the oils and metals that were mentioned earlier, GM plants also salvage about 120,000 tons a year of cardboard and paper.

Here is another unique approach. GMC Truck & Coach Division was in need of additional steam generation capacity, they desired greater fuel flexibility to cope with possible energy shortages, and they also wanted to reduce the substantial amounts they were paying to a contractor for the disposal of plant rubbish. They solved all these problems by installing two new boilers specifically designed to burn processed combustible wastes. About 55,000 tons of refuse per year will be burned, with a Btu value equivalent to 30,000 tons of coal, and at today's prices, that alone is worth $450,000.

We are also working with the National Center for Resource Recovery to establish a project in a major city to solve both the industrial and municipal solid waste problems, utilizing front-end recovery and back-end combustion and steam generation; and let me explain that terminology.

Currently, municipal and industrial solid waste is collected and usually sent to a landfill or incinerated. In either case the recovery value is zero. The proposed front-end system, by sorting and segregation, will recover aluminum, ferrous metals, glass, and recyclable paper. The remainder, about 80 percent of the total waste collected, will then go to the back-end system consisting of a waste heat boiler capable of generating high-quality steam for direct use or for generating electricity.

As you may know, General Motors conducted an abandoned car program in the fall of 1970 in Traverse City, Michigan. The experiences of GM in this particular program have been published in order to assist communities to help themselves in organizing and financing their own programs. This booklet, "How to Harvest Abandoned Cars," is available on request*. So far, more than 50,000 copies have been distributed to interested parties.

The experience gained in the GM pilot study is now being applied by the State of Michigan in its own junk car program, and last summer over 5,000 hulks were removed from the countryside. GM, along with other members of the Motor Vehicle Manufacturers Association, is supporting this program with financial and technical assistance. We think that the Michigan program could serve

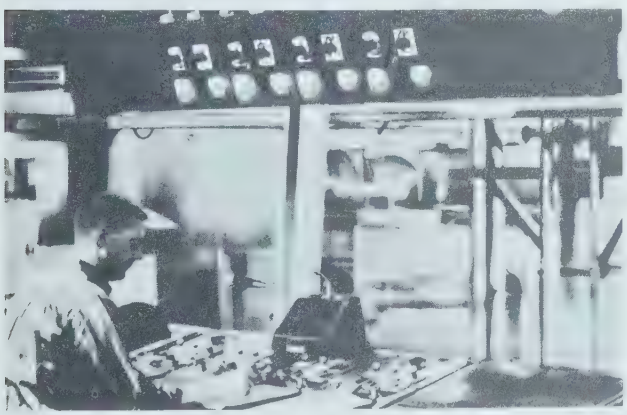
*Copies may be obtained by writing to General Motors Corporation, Room 1-101, GM Building, Detroit, Michigan 48202.

as a model for other states to follow in solving one segment of the solid waste problem.

Internal Plant Environment

One of our foremost in-plant environmental challenges is that of noise control. All of our manufacturing operations produce noise. Our corporate noise control program so far has identified the major noise producers; project priorities have been established based on the intensity of the noise and the number of people affected in each plant situation; quiet machine and equipment purchase specifications have been issued, and, although we have many obstacles to clear, we are determined to achieve our "quiet" objectives. Our plants are making noise reduction in the work areas one of their top priorities.

Another challenging problem is the control of the work place temperature, especially where the man is exposed to a concentrated heat source. In such areas, area-wide cooling systems are not effective, so we spot-cool or locate the employe in environmentally-treated rooms away from the actual work.



Air Conditioned Foundry Work Station

Central Foundry Division has used this technique for its people in the melting and pouring areas in Defiance, Ohio. Seven induction furnaces and ten pouring lines are controlled by operators in air conditioned rooms. This same technique is being used also in Central Foundry's Saginaw, Michigan, and Danville, Illinois, plants.

Over the years, GM's in-plant environmental programs have been aimed at providing our employes a safe place in which to work. Our concern about noise, airborne contaminants, toxicant levels, and heat was centered on the employe's health. That is no longer enough. Now we must also consider his basic comfort and aesthetic well-being and include in our design criteria elements such as temperature and humidity control, improved lighting, spatial relations, color, and more convenient and pleasant rest areas.

Conclusion

Certainly, the problems associated with industrial environmental control are not diminishing—just the opposite is true. To cope with the new complexities, we are doing a better job of planning, organizing and staffing.

The formation of the Environmental Activities Staff, the expansion of the Plant and Environmental Engineering Section, our research projects in SO_2 removal and TWCS, and the control hardware being installed by the divisions—these are all examples of our intent to maintain leadership and to achieve further progress in industrial environmental control.

Discussion Period

Responding to a question on the future effectiveness of coal usage, Mr. Tiberio replied that it is important to remember that sulfur dioxide comes from coal and to burn coal in an environmentally acceptable manner, we must control either the sulfur content of the coal itself or the equivalent output of sulfur dioxide. Most restrictive codes are based on the content or input side of coal—one-half of one percent sulfur. For all practical purposes, this coal is not readily available, and the amount that is available is used by the metallurgical industries. The General Motors Assembly Division's plant in St. Louis has a boiler flue gas scrubber which can reduce sulfur dioxide emissions by 90

percent. This would be comparable to lowering the sulfur content of the input coal from three percent to three-tenths of one percent. As an example, if one takes an average reduction of only 90 percent and is using coal with a sulfur content of three percent, only a 10 percent residue is left, or the equivalent of three-tenths of one percent. Therefore, this would be two-tenths of one percent better than any known limitation on the input side of coal. He went on to say that the St. Louis scrubber is very efficient and that its chemistry presents few problems, having been general knowledge in chemistry textbooks for many years. The big problem however, is in the design and building of hardware.

Another individual wanted to know when the sulfur dioxide scrubber at St. Louis would become feasible for installation in other GM plants. Mr. Tiberio replied that the GM sulfur dioxide removal program started in 1968 at a time when there had been very little application of the extensive literary theory on the subject obtained from laboratory experiments to basic process hardware. He mentioned that the sulfur dioxide removal program has been expanded to the Chevrolet-Cleveland plant where a system which can tolerate the variables found in the real-life operation of an industrial plant, such as fluctuating steam loads and human errors, will be tested. Although the system at Cleveland is scheduled to be operational by year-end, GM has plans under consideration for installing a similar system in two other plants. The objective here is to improve the process through experience gained in broader field operations. He concluded by saying that once the total operating costs, the system's process control capability, and the reliability of emission reduction can be determined, the decision will be made to install scrubbers at other plants. But, for now, it is only possible to go this far with unproven technology.

The question was asked if General Motors had investigated any methods or developed any techniques to recycle thermosetting plastic materials. Mr. Tiberio replied that because they do not decompose or are not degradable, plastics represent one of the challenges in utilizing waste materials. He went on to define waste as something that cannot be reused in the production process and indicated that the challenge lies both in product design and in developing ways to reuse waste from the production process. As of now, he stated, his group is working with other corporate staffs to develop re-utilization processes for scrap, including plastics.

An individual asked what the estimated cost would be to comply with the Occupational Safety and Health Act (OSHA) requirements and if GM expected a return on the investment. Mr. Tiberio stated that GM has established priorities in meeting the OSHA requirements and is spending millions of dollars toward their achievement. He continued by saying that GM expects an environmental return on its investment—that is, a return exemplified by a safer, healthier and quieter environment for its employes. He concluded by saying that GM is going beyond just the health aspect of the OSHA requirements and is looking at the broader question of basic comfort.

On the same subject, another person asked about GM's work in controlling noise to meet OSHA requirements. Mr. Tiberio replied that OSHA calls for achieving a noise level of 90 decibels in a plant for an eight hour exposure. This level, in itself, is misleading because the law defines what is called a unity factor which allows an individual to work for a certain length of time, according to a fixed scale, at a level above 90 decibels before he must be moved to a work area with a reduced level. From an administrative standpoint in a manufacturing operation, this mobility is almost impossible. GM, therefore, is approaching the noise level problem in two ways. The most readily convenient for the short run, of course, is for people to wear ear protection. This follows the intent of the law, which is to guard the hearing of employes. However, since this form of hearing protection could be physically uncomfortable, GM is pursuing a second approach of applying engineering technology to noise control. The machine industry recognizes this need for quieter machines and is devoting substantial research to meet the demand. GM has established noise level specifications for the purchase of quiet machines, and machine suppliers are now competitively bidding to meet these specifications. The result has been a tremendous improvement in the working environment through the reduction of machine noise.

In response to a question on the most important causative factor to GM in undertaking the various pollution control projects, Mr. Tiberio stated that a partial stimulus was from Federal and state

legislation, but that GM has always maintained an interest in controlling environmental degradation in areas where its plants are located. He pointed out that GM started its water-pollution control program in 1947 at a New Departure-Hyatt plant in Sandusky, Ohio, and that the treatment facility was installed before there was widespread enactment of pollution control laws. He added that the Sandusky plant still meets all local water-pollution control laws.

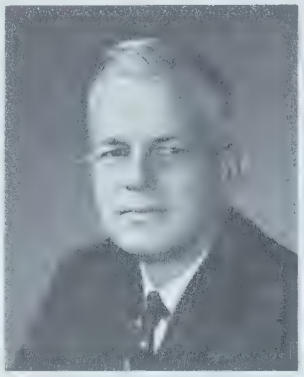
The question was asked as to the feasibility of recycling older cars and as to the position GM is taking on taxing new cars to pay for the disposal of older models. Mr. Cole replied that tests using scrap from older cars have been run at GM foundries where the scrap is readily usable and can be delivered to the foundries at a reasonable cost. He mentioned that the problem in achieving an overall economical program is not only in attaining favorable freight economics but in lowering the cost of refining and reducing the scrap. He stated that the GM program includes work with the Southern Pacific Transportation Company on the West Coast in building special rail cars which can economically haul a load of 110,000 pounds of scrap metal and thereby permit the usage of scrap originating at greater distances from foundries. He emphasized that the overall problem is one of economics and pointed out that there is more than sheet metal and iron in old cars. There is chrome, lead, zinc, and other valuable by-products which can be reused if economical processes can be utilized for their separation and segregation. This work is now going on at one of the country's largest reducing operations on the West Coast. There are over 80 similar systems in operation around the country and from this experience it appears that the economics of the system are becoming more favorable. But, Mr. Cole added that the prices of scrap fluctuate from day to day and month to month and such fluctuation bears on the economics of the system. Mr. Cole concluded by saying that when the considerable amount of work now going on makes scrap car recycling economical, which appears likely, there will be no need to impose a tax on new cars.

An individual asked whether GM's pollution control systems in its U.S. plants are also installed at its overseas facilities and further whether GM has gained any experience from pollution control systems in other countries. Mr. Tiberio replied that although the majority of GM's pollution control efforts have been in the U.S., his group acts as a consulting organization to all GM plants regardless of where they are located. He mentioned that engineers from his group have made visits to GM plants in the Republic of South Africa, countries in South America and Europe. He indicated that an oil waste removal system first developed and installed at GM's Antwerp, Belgium, plant is now being applied at the Chevrolet plants in Massena and Tonawanda, New York. Mr. Tiberio concluded by saying that there is an exchange of information and technology through environmental engineering seminars and technical meetings and that maintaining a clean environment is a world-wide problem and any developments that are made must be applied on a world-wide basis.

AUTOMOTIVE EMISSION CONTROL

Dr. Frederick W. Bowditch

DR. FREDERICK W. BOWDITCH, *Director of Automotive Emission Control for the General Motors Environmental Activities Staff, represents GM on matters involving automotive air-pollution control and is responsible for coordinating GM emission-control activities, the analysis of current and proposed legislation, and the assessment of future control requirements.*



Dr. Bowditch received a B.S. degree in Mechanical Engineering from the University of Illinois in 1943. Following military service, he attended Purdue University which granted him the M.S.M.E. degree in 1948 and Ph.D. degree in Mechanical Engineering in 1951. He then joined the Fuels and Lubricants Department of the GM Research Laboratories and was involved with research on engine combustion and carburetion. He advanced to the position of senior research engineer before being appointed a staff engineer with the GM Engineering Staff in 1966. He became Director of Emission Control, Engineering Staff, in 1968. He assumed his present position with the formation of the Environmental Activities Staff in 1971.

Between 1964 and 1968, Dr. Bowditch was chairman of the Motor Vehicle Manufacturers Association's Vehicle Combustion Products Committee and served as the automotive industry's spokesman before government regulatory agencies. He also served as chairman of the MVMA's Air Quality Committee from the time of its formation in December 1967 until June 1968. He is currently a member of both Committees.

Dr. Bowditch is the GM corporate member of the Air Pollution Control Association and has served on the Association's Board of Directors. He is a member of the Society of Automotive Engineers and, in 1952, received the SAE's Horning Memorial Award and Medal for his research work on combustion deposit ignition.

The control of automotive emissions has for some time been a high priority, all-out effort at General Motors. Mr. Cole has already mentioned the substantial current commitment in resources which General Motors is devoting to the task.

Perspective

The efforts toward control of automobile emissions are not new at General Motors—or for that matter in the automotive industry. We have been working on research and development for emission controls for almost two decades—ever since the car was first defined as a significant contributor to air pollution in Los Angeles. However, the steps between identifying the problem and finding a solution were not so simple as just building a piece of hardware to install in a car for control of emissions.

New technology had to be developed and many basic investigations had to be conducted to:

- Understand the problems
- Devise accurate instrumentation
- Develop techniques for measurement
- Innovate the control hardware.

Over the years, the technical community has made significant contributions to progress in all these areas.

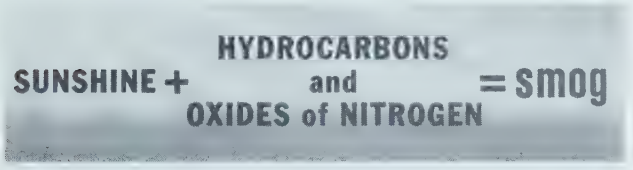
Urban Air Pollution

While it has not been obvious to the impatient environmentalists who demand extreme measures immediately, progress in these areas is by necessity accomplished sequentially rather than simultaneously, because positive results in one area frequently depend on success in another.

Further, the role of the automobile in air pollution is frequently misunderstood. It is not the sole contributor as some ecology buffs would like you to believe. In fact, it does not contribute significantly to all types of air pollution. We will confine ourselves in this presentation to the areas which we call urban or community-wide air pollution.

London-type air pollution usually occurs during winter months under certain weather conditions when sulfur dioxide and particulates, much of them from coal fires, are held close to the ground. This type of air pollution has had serious consequences over the past few centuries. Actually, the first ordinance for this type of air pollution was proclaimed by the British Parliament in 1306.

During one week in December 1952, London smog was accredited with about 4,000 "excess deaths", and an additional 8,000 deaths during the following three months. Corrective measures were instituted, and since that time London has had only one serious episode which occurred in December 1962 and has been blamed for approximately 750 deaths. Other cities including some of our eastern industrial cities have experienced London-type air-pollution problems, but to a less serious extent. The automobile does not contribute significantly to the London-type urban air-pollution problem.



Smog Equation

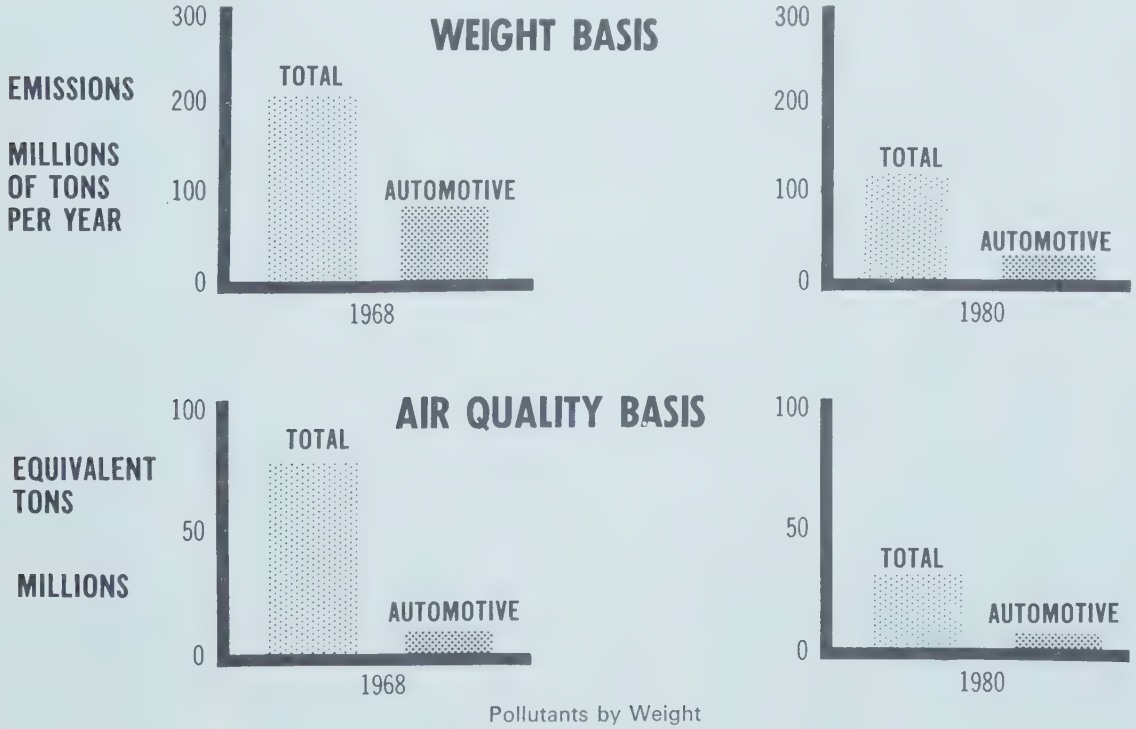
The pollutants from automobiles which do contribute to urban air-pollution problems are hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO_x). Carbon monoxide is of concern because with sufficiently high concentration, it can have adverse health effects. However, CO from automobiles usually dissipates rapidly in the atmosphere. The concern of regulatory agencies is for urban areas where high traffic density during the rush hours causes a buildup of CO concentrations at street level, especially among tall buildings that shield the streets from wind which might otherwise dissipate the exhaust fumes.

Hydrocarbons and oxides of nitrogen are of concern because they enter into a photochemical reaction when they are exposed to sunlight in stagnant air. This is the famous Los Angeles smog. While the eye irritating characteristics of Los Angeles smog are well known, it has not been blamed for fatalities.

Pollutants By Weight

One way to evaluate the importance of the various sources of air pollution is to look at the total weight of pollutants. Using the most recent published Federal inventory of all sources and adding up the tons of pollutants from each, independent of the pollutant, we obtain the information shown in the graph below. In this comparison, the automobile accounts for roughly 40 percent of the nation's air pollution.

Looking ahead to 1980, and assuming the other sources of air pollution are controlled as planned, the situation shows that the automobile will be about 26 percent of the total and that the total



Pollutants by Weight

levels will be down substantially.

Looking at the air-pollution problem on a weight basis alone, however, does not take into account the large variation in health associated considerations of the various pollutants. If we look at both health effects and total weight considerations, a comparison can be computed which shows, on a nationwide average basis, that the automobile is only 10 to 15 percent of the air-pollution problem. In other words, if all automobile air pollution was removed from the atmosphere we would only eliminate 10 to 15 percent of the nation's air pollution. Projecting again to 1980, the situation looks something like that shown in the graph.

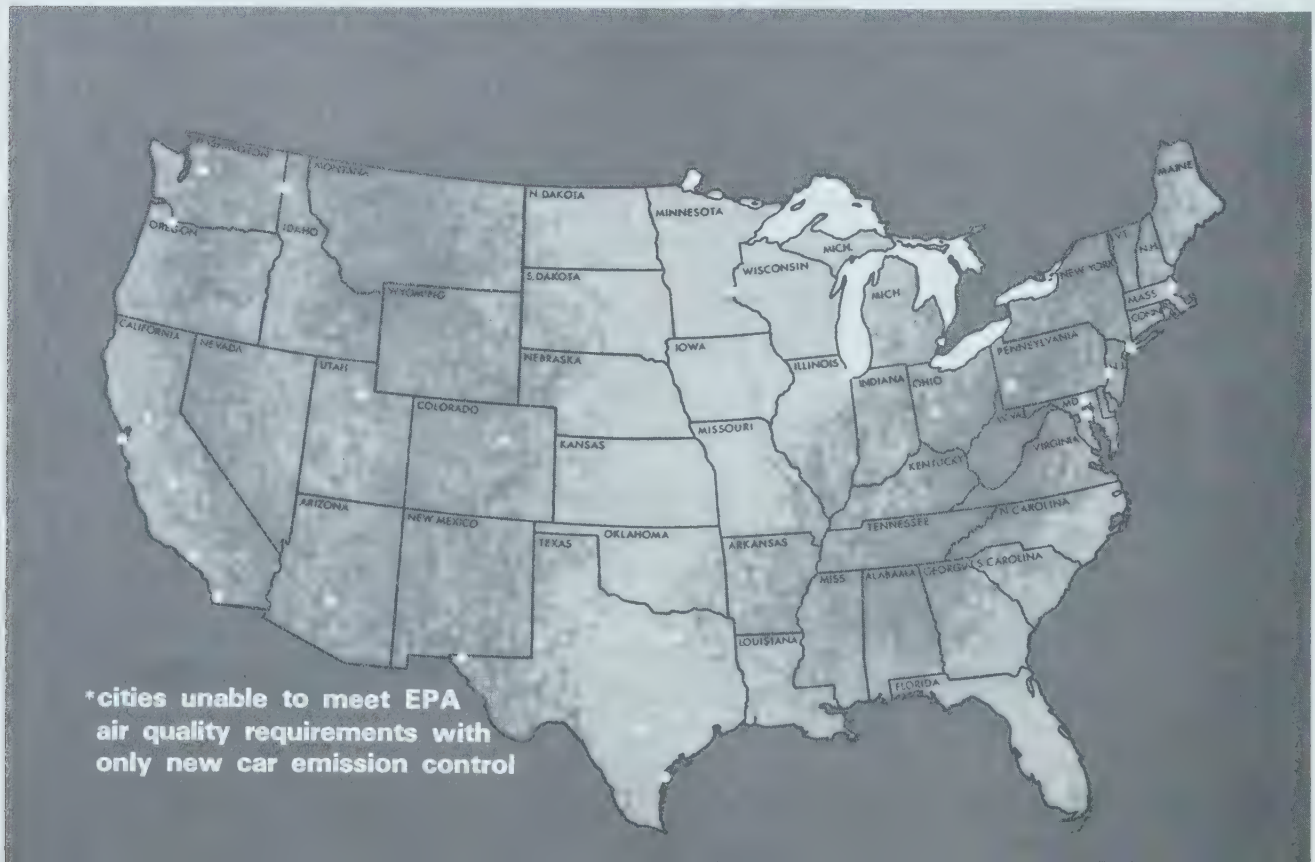
Such information, however, really gives no valid information on the extent of the problem in individual urban areas. While national air pollution in general, and automotive air pollution in particular, is on the decrease, it is not correct to conclude that there are no urban automotive air-pollution related problems. As a matter of fact, as part of its responsibility under the 1970 Clear Air Amendments, the Environmental Protection Agency is requiring all states to determine how their urban areas will meet very stringent air quality standards. The most newsworthy example of this is the recent announcement by Mr. Ruckelshaus that traffic in the Los Angeles area must be restricted by 80 percent in the smog season of 1975 if that area is to meet the severe EPA ambient air standards.

Similar problems, to a much lesser degree, are occurring in many other areas of the nation. In each of 26 urban cities, some additional form of automotive emission control, such as traffic restriction, will be necessary to meet the EPA requirements by the target years.

Most of these problems would be solved if the date of compliance was delayed a few years because the continual decrease in the automotive pollutants would reduce the urban concentrations of these pollutants to levels below the required ambient standards. This is but one of the inconsistencies in the Clean Air Act.

However, in those areas that cannot be handled in this manner, perhaps a two-car strategy is the best approach to the problem. That is, cars equipped with the most sophisticated emission-control equipment would be used in those areas with severe urban problems, and cars with present-day equipment would be used in the rest of the nation. Even now, most of the country would be satisfied with the present-day equipment. This is

Cities With Automotive Air Pollution Problems*



a philosophy we are considering in General Motors, and one that we think has a number of attractive features.

Let's discuss, now, where we are today in terms of automotive control, and what is the potential in the future.

Considering the progress that we have made to date, we have not yet succeeded in taking the automobile completely out of the nation's air pollution problem, but we are getting closer to it. Compared with the uncontrolled cars of a decade ago, exhaust hydrocarbons have been reduced over 80 percent, carbon monoxide over 70 percent and oxides of nitrogen are projected for about 40 percent reduction as the result of additional NO_x controls for 1973.

It is significant that we have turned the corner. As a result of our efforts, even though the number of cars and trucks on the American roads increases every day, their effect on our air lessens every day. This improvement will continue with each passing year as the newer, lower emitting models replace the old uncontrolled models. Despite the difficulties which had been encountered in achieving these reductions, progress has come at a very reasonable cost to the customer. According to the National Academy of Sciences estimate, an average cost to the customer of all domestic 1973 model systems is approximately $100 per car.

Clean Air Act

In 1970, Congress amended the Clean Air Act which established new air-pollution requirements. These new requirements were designed to accelerate the achievement of clean air by advancing the levels desired for 1980 to the 1975-1976 schedule.

FEDERAL EXHAUST EMISSION REQUIREMENTS
1975 TEST PROCEDURE
Grams Per Mile

	Prior to Control (1960)	1968	1970	1972	1973	1975-76
HC	15	6.3	4.1	3.0	3.0	0.41
CO	90	51	34	28	28	3.4
NO_x	5	5	5	5	3.1	0.4

The chart at the bottom of the first column shows the 1975-76 standards and the standards for the earlier years, which have been adjusted to the same basis for comparison; namely, the 1975 test procedure. By comparison, it can be seen that the values for the 1975 and 1976 standards are a drastic departure from the earlier progression.

In regard to emission reductions, the chart below shows the percentage reductions for the 1975 and 1976 standards as compared with the 1972 and the current levels for 1973. The law required a 10 to 1 or 90 percent reduction from the 1970 and 1971 levels, but from the uncontrolled car levels this represents a total of from 92 to 97 percent reduction in emissions. As Mr. Cole has suggested, these reductions would be even larger if every 1975-76 car rather than the average car is required to meet the standards. We feel strongly that the provisions of the Clean Air Act, as amended with respect to automotive emissions, will not provide benefits commensurate with the cost to our economy.

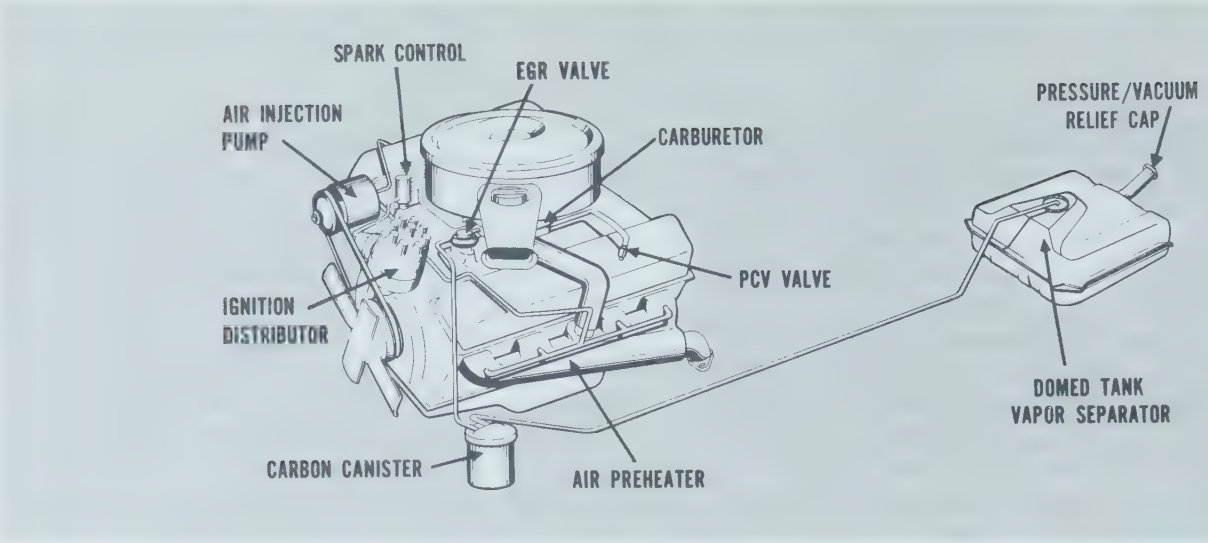
EMISSION REDUCTIONS BASED ON FEDERAL STANDARDS

	PERCENT REDUCTION FROM UNCONTROLLED LEVELS			
	1972 %	1973 %	1975 %	1976 %
Hydrocarbons	80	80	97	97
Carbon Monoxide	69	69	96	96
Oxides Of Nitrogen	–	38	38	92

Approaches to Emission Control

Meeting these emission requirements is one of the greatest technical challenges that we have ever faced in General Motors, but we are making progress, and I'd like to discuss that with you.

First, what broad approaches are there? A frequent proposal by the uninitiated is to abandon the gasoline engine. Alternatively, the conventional piston engine can be further modified for emission control. We have evaluated many alternate means of furnishing power for automobiles and in most



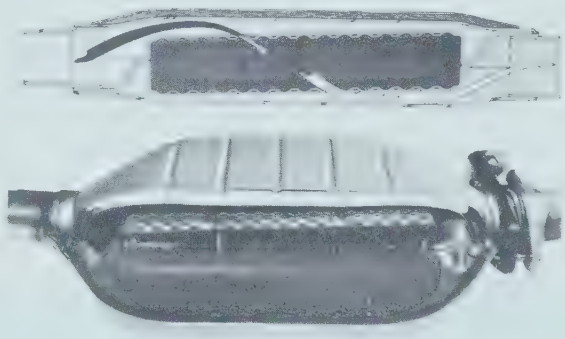
1973 Emission-Control System

cases have built cars with the alternate powerplants. We have built cars powered by a steam engine, Stirling cycle engine, gas turbine engine, fuel cells, batteries, and hybrid powerplants—plus, the rotary combustion engine which is really another spark ignited gasoline engine. Almost without exception, however, we find that even if we solve all the standard problems of mass production, we still have a powerplant which requires added emission control to meet the future emission requirements—in other words, we haven't solved the emission problem by shifting powerplants.

This then leaves us with the cleanup of the gasoline engine as the most practical solution to our problem if we can make it meet the emission requirements. If we look at the 1973 system, we find that many of the exhaust emission-control features are engine modifications. As emission standards have been progressively tightened, supplementary control devices were developed. This year, for instance, exhaust gas recirculation (EGR) was added to reduce oxides of nitrogen.

For 1975, it appears that catalytic treatment of the exhaust gas will be necessary. For those of you who have forgotten your chemistry, a catalyst is a substance which helps a chemical reaction without changing its own form in the process. So ideally, a catalyst should last indefinitely.

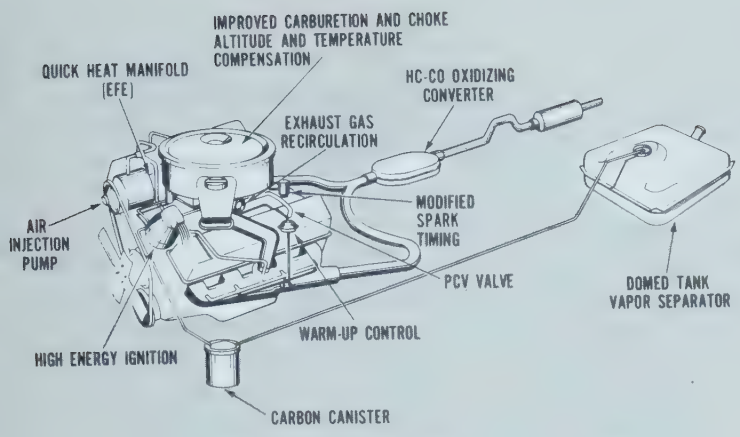
One catalytic converter under development is intended for installation in the exhaust system under the passenger compartment, much the same as one of our current mufflers. It is filled with beads of substrate material coated with a catalyst and held in a perforated container such that the exhaust gases must pass down through the catalyst bed on their way out of the exhaust system. During the development of catalysts, which is still going on, incidentally, 971 catalysts from 51 different suppliers have been evaluated.



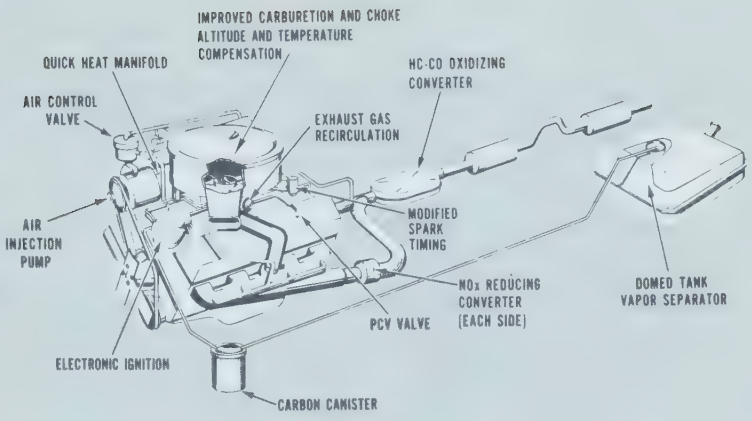
Catalytic Converter

The total advanced emission-control system which is designed to meet 1975 standards with the underfloor converter has many refinements over the 1973 emission-control system. The future carburetor will include altitude compensation for improved air-fuel mixture control. There also is a quick heat manifold (or Early Fuel Evaporation System—EFE) for improved warmup operation and, of course, the catalytic converter in the exhaust pipe. In addition to exhaust emission controls, the system has evaporative emission controls such as a carbon canister and domed fuel tank. In addition, the advanced system has a crankcase control system with a positive crankcase ventilation (PCV) valve.

The underfloor system is one of two catalytic approaches we are following simultaneously. The

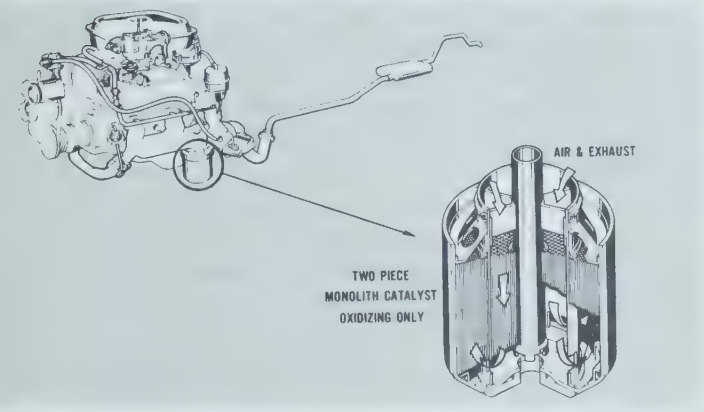


1975 Emission-Control System



1976 Underfloor Emission-Control System

second catalytic approach is one in which the same catalyst is held in a pocket in the exhaust manifold up close to the engine. This has been named the D-MECS (Dual Mode Emission Control System) approach. Once we have resolved the problems in one of the two approaches, we will drop the other one. But today, we cannot afford to take any chances, so we are pursuing both vigorously—and also continuing work on other possibilities, but these two look the most promising.



Alternate D-MECS Catalytic Approach

In the emission control systems for 1975, emphasis is placed on the control of hydrocarbons and carbon monoxide. The standards require control of these pollutants to a reduction of 97 percent and 96 percent, respectively. In the 1976 underfloor emission-control system, the emphasis is placed on the control of oxides of nitrogen, too. Controlling NO_x to very low levels requires the use of reducing catalysts—that is, catalysts that will separate the oxides of nitrogen into free nitrogen and free oxygen. In this case, all of the components used in the 1975 control system are retained, but with the addition of reducing catalysts.

Up to now, the emission-control systems have utilized engine modifications and additional components like building blocks, adding new features to meet the requirements as the standards become more stringent. The oxides of nitrogen change in the standards for the 1976 model year represents a most drastic change. The step change of emission reduction from the 1975 oxides of nitrogen level of about 40 percent to 92 percent reduction is a large step—almost 2½ times. This change requires a complete rebalancing of the system, not the simple addition of a single component.

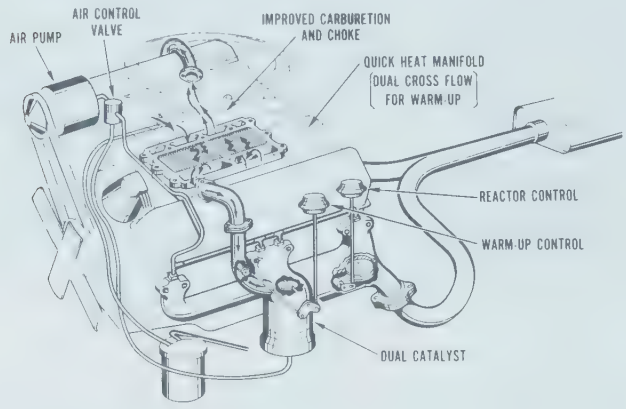
As with the 1975 catalyst approaches, we are following a second approach called T-MECS (Triple Mode Emission Control System) for 1976. Here, both the reducing and oxidizing catalysts are held in the exhaust manifold. If we are able to make this one work, it may result in a significant cost saving over the underfloor approach.

Status of Development

Now, how well do these systems operate? How close are we to meeting those 1975-1976 standards?

The 1975 and 1976 emission levels have been achieved with some experimental cars equipped with these prototype systems at low mileage. Some experimental cars have also failed at low mileage. Some 1975 system experimental cars have even gone 50,000 miles under carefully controlled conditions. But that is only part of our problem. Another requirement of the Clean Air Act is the stipulation

that vehicles must maintain their emission performance for five years or 50,000 miles in the hands of the consumer.



Alternate T-MECS Approach to Emission Control

We are making progress in improving catalyst durability, but there is a tremendous difference between driving 50,000 miles on proving ground roads during an interval of the few months it requires to drive that distance, as compared to what will occur in the hands of the average driver over several years in all kinds of weather and road conditions with various levels of vehicle maintenance.

To the best of our knowledge in GM, using current estimates available based upon the technology as we see it today, the retail prices of cars equipped with the systems we are developing for 1975 and 1976 would be increased by $275 over today's prices. This would recover our cost and would not include any markup for the manufacturer. This does not include any provision for additional maintenance, additional fuel, catalyst replacement, or any return on our investment. And we must spend in excess of $500 million to provide the facilities and tools to mass produce this hardware. As a manufacturer, we would expect some return on this investment.

If the industry is granted the lead time we need, and the allowance for averaging, our efforts to meet the objectives of the Clean Air Act can go forward with the least cost. The individual car buyer as well as society as a whole will, therefore, benefit.

We do need averaging—for certification, for assembly line testing, and field surveillance. We do need more time for proper development and testing. And even then we do not at this time have the assurance that we can develop and mass produce these systems to meet the requirement of the Clean Air Act.

Meanwhile, General Motors will continue to make every effort to develop and test these control systems. While this work is going on, we will continue to seek, through every available means, modifications and interpretations of the law that will enable our industry to continue to provide products of maximum value and satisfaction to our customers.

Discussion Period

An individual asked Dr. Bowditch if he would comment on a recent magazine article which suggested that the experimental GM rotary engine was not passing emission control tests. He replied that since the rotary engine is a spark ignited gasoline engine, it is amenable to the same kind of emission control approaches being taken with the piston engine. He further stated that the rotary engine development is, obviously, a little behind GM's program with the piston engine, but that he saw no reason why emissions from the rotary engine could not be just as successfully controlled once GM gets to the point of manufacturing.

Another individual asked why increased fuel consumption didn't necessarily mean increased emissions. Dr. Bowditch replied that converting gasoline to moving a car down the road can be looked at as a two step process. The first step is to convert the gasoline to heat and the second step is to convert the heat to the mechanical energy needed to drive the car. Dr. Bowditch said that a good job is being done in converting the gasoline to heat, but that in the job of controlling emissions, the heat is not being used efficiently. As a result,

some of the heat that would otherwise be used to create mechanical energy is being wasted. He pointed out that in order to oxidize pollutants like hydrocarbons and carbon monoxide, higher exhaust system temperatures are needed, and this is where some of the heat normally used for creating mechanical energy is being put to use. We are not wasting the heat in terms of what we need for the control of emissions, but we are losing it in terms of mechanical energy.

Responding to a question about the "Honda solution" for emissions control, Dr. Bowditch replied that the Honda system is a stratified-charge type of engine and that the GM Research Laboratories has been studying a variety of these stratified engines over a period of years. He noted that GM engineers have encountered a number of problems with the stratified-charge engine and that Honda has apparently found solutions to some of these difficulties in the case of their CVCC engine. Dr. Bowditch further stated that as nearly as can be determined, using Honda data, and from GM's own experience, the dual-carbureted stratified-charge concept produces insufficient emission control at this point in its development either to meet the 1975 emission requirements in average-weight U.S. cars (4,500 lb) or to meet 1976 emission requirements even for lightweight vehicles. Dr. Bowditch indicated that the stratified-charge concept, or perhaps one of the other dilute combustion engine concepts, holds promise as an automotive powerplant and that GM is continuing research and development on the engine.

A question was asked concerning what the miles per gallon might be when the 1975 and 1976 emission control systems with catalytic converters are applied to engines and what the cost might be to the consumer for extra gasoline. Dr. Bowditch answered that if the proposed GM 1975 system does the job, there probably would be no added fuel penalty above that of the 1973 cars. He added that a problem might occur, however, with the 1976 system. He mentioned that since a stringent oxides of nitrogen regulation occurs for the 1976 car, one way to minimize the oxides of nitrogen is to operate the engine at a rich air-fuel ratio (more fuel than air) so there will be little oxygen present to form the oxides. He pointed out that this could result in a substantial increase in fuel consumption. Dr. Bowditch added that if the reducing catalyst system can be made to work at more reasonable air-fuel ratios, then there probably would not be much of an additional loss in fuel consumption.

An individual asked that if the emissions output of cars were to be based on averaging those from all cars, what would happen when a customer who purchased a car having an emission output on the high side brought it in for examination. Dr. Bowditch replied that whether or not the customer's car would pass depends entirely upon how this part of the requirement is finally stated. He made the point that for every car on the "high side," there is also one on the "low side." The atmosphere responds to the emissions of all cars. He mentioned that GM and others are working with the environmental protection agencies in the states on various approaches that would take care of the problem. He went on to say that the atmosphere is not materially affected by an individual car's emissions and that there are acceptable ways to measure emissions from cars in service. A cut-off point could be determined, for example, where most of the cars if they are properly maintained would operate properly within emissions limits. If a car were above that point, then it would have to be fixed and the manufacturer would bear the cost.

A question was asked about the various heat dissipation problems that will occur under the hood and under the floor with the catalytic converter systems under development. Dr. Bowditch answered that there would be increased underhood temperatures and that such things as brake fluid, plastics, and many other components located under the hood are being looked at to make sure they will not be adversely affected by the higher temperatures. He stated that various changes are being made and that no problems should result. In regard to the underfloor catalytic converter system, Dr. Bowditch indicated that extra insulation would be added between the top of the converter and the floor pan to isolate the passenger compartment from the higher temperatures.

In reply to questions about catalysts, Dr. Bowditch stated that the same basic catalysts—platinum and palladium—would be used in all the proposed emission control systems and that there may be some base metals mixed with these noble metals. He said that this has not been finally settled as yet because of durability problems presently being experienced.

GENERAL MOTORS AND ENERGY CONSERVATION

Ernest S. Starkman

ERNEST S. STARKMAN, *prior to his appointment as Vice President in charge of the Environmental Activities Staff in April 1971, was professor of mechanical engineering, University of California, Berkeley and assistant vice president for the Statewide University. Before assuming these positions, he had been chairman of the Thermal Systems Division of the College of Engineering.*

Mr. Starkman received a B.S. degree in 1942 and an M.S. degree in 1945 from the University of California at Berkeley. He held positions in private industry before returning to the University to assume teaching and administrative positions. He became a professor there in 1960.

Mr. Starkman has authored over 100 technical papers on engine fuels, lubricants, and combustion and received the Society of Automotive Engineers' Horning Memorial Award and Medal in 1959 and the Colwell Award in 1968 for papers relating to engine combustion. He served as chairman of the Technical Advisory Committee to the State of California Air Resources Board from 1968 to 1971 and was chairman of the Advisory Committee on Advanced Power Systems to the Council of Environmental Quality. He is presently a member of the Technical Advisory Board, U.S. Department of Commerce.

Mr. Starkman holds membership in numerous engineering and honorary societies. He was named Professor Emeritus in the University of California's Department of Mechanical Engineering, Berkeley Campus, in April 1971.

Historically, the advance of civilization has been measured in terms of man's ability to utilize the abundances of nature for enhancing his comfort, mobility, commerce and communication. This progress commenced with learning how to use the energy from burning twigs to heat and light his cave. It developed with domestication of animals to transport himself and his burdens over land and the taming of the wind to speed his progress on the seas. It was multiplied when he learned how to use fire to do his chores through invention of the heat engine. Today, there seems no limit to what man can accomplish with the enormous and concentrated stores of nature's energy which have become mobile and available. Man can kindle fires to heat or cool; he can throw a switch to move himself and his goods over fantastic distances in brief periods of time, or press a button to communicate with or be informed by any other man on, or off, the surface of his planet.

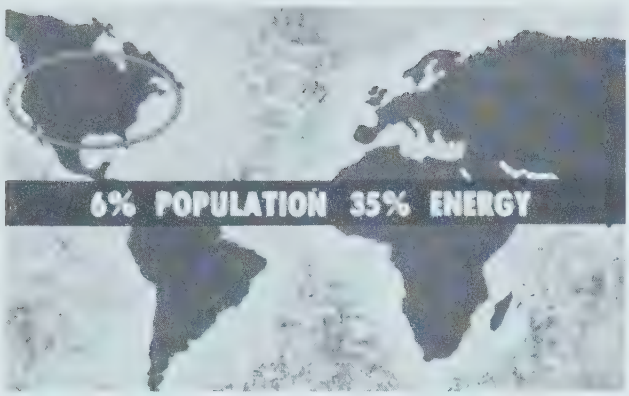
But suddenly, man has come to the realization that with his capability to multiply enormously his own feeble efforts has also evolved a threat to his progress resulting from improper management of that energy. And thus, in this country at least, has come the present "energy crisis," in reality more properly a clean energy shortage or even a clean energy usage and distribution problem.

I would like to take a few minutes to discuss this energy dilemma in a number of its dimensions and manifestations as it relates to General Motors. At the outset, it must be recognized that the problem is already upon us and that action must be taken in the near term. Concurrently with the effecting of near term solutions, we also must be developing rational approaches to future energy requirements. Further, it almost goes without saying that the problems are not only national in scope, but worldwide, and while they transcend General Motors, they also most intimately affect us both here and abroad. The effect is in itself two dimensional; on the one hand the way the manufacturing of products is pursued, with due accounting for energy availability and usage; and on the other hand how GM's products themselves affect or will be affected by energy considerations.

National Energy Picture

To get a better understanding of how this country has moved from a long period of abundance to a time of growing scarcity in energy resources, let's take a look at the national energy picture.

The U.S. is the world's largest energy user. We have only 6 percent of the world's population, but we consume nearly 35 percent of the energy used worldwide.



Population and Energy Use

While I hesitate to bore you with statistics, bear with me while we try to establish the present state of affairs.

On the source side, the approximate total continental United States energy consumption originates from: oil 44 percent; natural gas 33 percent; coal 18 percent; nuclear and hydro-electric combined—5 percent. Please note and keep in mind that we now use coal for less than one-fifth of our energy needs. We will return to this later.

On the application side, residential and commercial applications account for 21 percent; industrial 29 percent; transportation 25 percent (nearly all of which is petroleum); and electrical utilities 25 percent.

Over the past 20 years, U.S. energy consumption has doubled. Estimates show that in the next 12 years, by 1985, the demand will double again. And experts predict that by the year 2000, assuming no radical departure from experience to date, the nation will be using three times the energy we are using now.

While domestic oil production from established reserves is at its peak, exploration and drilling activities, partly through lack of policy and economic incentives, have dropped 50 percent since 1956. Even with full use of Alaskan oil, future domestic finds, unless radically increased, will not be able to maintain existing production rates. The rate of domestic utilization has passed the rate of domestic discovery.

Oil imports for 1973 are expected to provide about 35 percent of our oil supply. By 1980, imports are projected to comprise at least half of our oil supply—an amount almost equal to the combined output in 1970 of three of the largest Middle East oil producers. You, of course, appreciate that this will not only adversely affect the balance of payments, but it also poses uncertainties with respect to continuity of supply. Furthermore, Europe, Japan and the rest of the world will be competing for their share of this same Mid-East oil.

Demand for natural gas is high and will continue to rise for two reasons. First and foremost, it burns cleanly. Secondly, it is presently cheap because regulation keeps the price low.

Economic factors over the past few years have discouraged natural gas exploration. For discovery to keep up with production would require additional finds each year equal to the amount of

SOURCE

Oil	44%
Natural gas	33%
Coal	18%
Nuclear and Hydro-electric	5%

APPLICATION

Residential and Commercial	21%
Industrial	29%
Transportation	25%
Electrical Utilities	25%

Energy Supply and Demand

gas in Alaska's North Slope.

For the short term, little relief for the shortage of natural gas can be expected during the 1970's, even with substitution of propane, imported liquid natural gas, reformed oil to gas, or coal gasification. The present "natural gas gap" appears likely to persist.

GM is obviously interested in burning clean fuels, and our plants currently rely heavily on natural gas for a significant part of their energy supply, particularly for such processes as heat treating and drying, where cleanliness is essential to the process.

The Problems With Coal

The obvious question which follows is, why not use some other available fuel, for example, coal? At current production rates, coal would supply the U.S. for about 400 years with proven reserves and 2,600 years if potential reserves are added.

Even more attractive is the fact that almost half of the world's coal supply is in North America. Everything seems to point to coal as the fuel to use for industrial boilers and electrical production for both the short term and long term. It could additionally buy us time while we search for new domestic supplies of oil and natural gas, sink wells, build refineries and develop new, alternate sources of energy.

But coal poses special problems, and to quote a recent article in the *Smithsonian*, "Coal is cheap, hated, abundant, filthy and needed." But it is mostly a "dirty" fuel, containing both sulfur and ash. And we are not happy to discharge these substances to the air.

The lowest sulfur content fuel lies close to the surface, and getting coal out of the ground is most easily accomplished by strip mining. But legislation is in the making which might control strip mining, further constraining available supplies of low sulfur coal.

To use coal as a fuel, it either has to be cleaned up before burning, or the combustion gases have to be treated to make them acceptably clean before venting to the atmosphere. You have already been told about GM's efforts and progress in making coal a respected and acceptable member of our family of energy sources. We have great hopes for treating the effluent stack gases so that neither the sulfur nor the dust particles resulting from coal combustion will exceed the acceptable levels for health and cleanliness.

Nuclear Energy

While not much hope is held out for increasing hydro-electric supply because most feasible sources have already been harnessed, nuclear energy still has promise. A bright dream in the early 1960's, it has dimmed somewhat lately because of increased building costs and attack from some quarters on its alleged radiation and thermal water-pollution damage. There is also a growing realization that uranium is not plentiful enough to meet our future demand.

In this regard, the fast breeder reactor holds promise for producing electric power and creating more nuclear fuel than it consumes. It also apparently produces less waste and has less chance of leakage of radioactive gases. A demonstration breeder is being built near Oak Ridge, Tennessee, and, if it is successful, we may see some commercial power from breeders, hopefully before 1985.

GM's Energy Conservation Program

GM recognizes most clearly that a continuing, successful operation is dependent on a viable national energy base. Action is needed, and GM is not standing still. While we would prefer to burn clean natural gas or petroleum fuels for as much of our needs as we possibly can, we are aware of the present and impending shortages. We are therefore trying to use more available substitutes, particularly coal, and we are most anxious for early successful completion of our SO_2 emission control developments. For the short term we are backstopping our natural gas with propane and fuel oil, particularly for applications where we must absolutely have low or non-sulfur heat for processing. And we are urging, for the near future, that natural gas be used preferentially—only where substitutes cannot be easily applied. Thus, residential applications should be first on any list, but we feel that for the present, at least, available gas should be used for processing before being used for power generation.

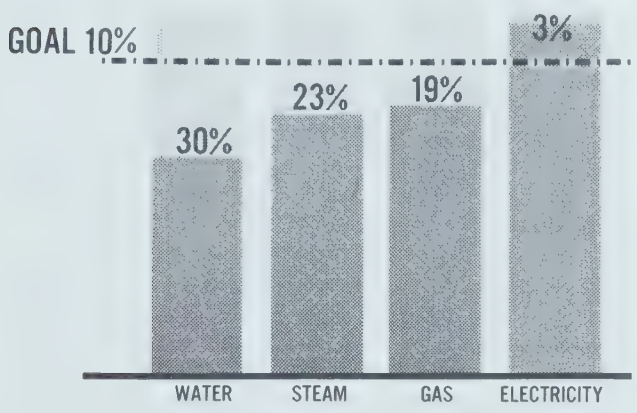
But for the short term, GM can do more than has been outlined thus far in this presentation. One effort we already have launched into is the conservation of our energy. Responsibility for implementing a conservation program rests with the

individual GM plants. They establish energy conservation goals, develop techniques to measure progress in conserving energy and maintain records to keep management apprised of energy usage.

The efforts at the plant level are supported by a GM in-house energy planning group which helps foresee how energy trends will affect us. Members of this group not only provide the divisions with guidance in fuel planning, purchasing, research and investment decisions, but also monitor supply and demand and assess political and regulatory changes.

Additionally, the GM energy group coordinates the corporate energy conservation program to find ways to conserve and better utilize our energy resources and still meet environmental challenges.

As a consequence of this conservation program, one of our large Midwest plants has already achieved impressive results during the past year.



Energy Conservation Results At One GM Plant

Started in the summer of 1971 with a 10 percent reduction in utilities usage established as a goal, the program a year later showed a 30 percent reduction in water usage, a 23 percent reduction in steam, a 19 percent reduction in natural gas and a 3 percent reduction in electricity. These reductions not only helped the energy shortage but yielded a handsome cost savings of almost $900,000.

To maintain these savings in energy and expenditures will necessitate constant vigilance. This particular program now serves as a model and is being employed in many of our plants.

Future Considerations

But what about the long term? Here GM must obviously be in concert with national priorities and goals, which are only in the early processes of being shaped. We have studied the energy dilemma and formulated our list of where the problems and opportunities exist. Let me delineate a few.

The nation may really have the potential for being totally self-sufficient in energy. Current technology is available for much greater recovery of our natural resources. But a "hold" has been put on some of it by the government and courts. As an example, a substantial supply of oil and natural gas in Alaska still awaits resolution by the courts or Congress of the environmental concern associated with a Trans-Alaskan pipeline.

Federal leasing policy is presently limiting land use. Well over 50 percent of our remaining natural energy resources—coal, oil, gas, shale, geo-thermal and uranium—are on public lands. Federal laws provide for the orderly development of Federal lands by private enterprise, but there has been effective blockage by environmental laws, and the development of the nation's abundant energy supplies is virtually at a standstill. Serious delays are occurring in the release of onshore and offshore Federal lands for development.

Research and development on energy has been seriously out of balance. While nuclear power generation has been generously funded, similar attention has not been paid to coal and shale utilization, nor to solar and geo-thermal sources.

In the absence of sufficient domestic oil and natural gas, we must turn to imports. The nation currently imports about 4 percent of its natural gas supply and 35 percent of its oil. By 1980, we could be importing 18 percent of our gas needs and over 50 percent of our oil needs.

With such a heavy reliance on imports, there are obvious national security and economic implications. The nation needs a flexible import plan to provide adequate oil supplies until the trend of heavy dependence can be reversed. While the U.S. seems to have no other choice for the remainder of this decade than to become heavily dependent on imports, the level of dependency can be made more tolerable by accelerated programs to develop our nation's own capability.

But our national objective must include equitable trade relations with all our foreign sources.

There are many other areas than those of resource development, already touched on, to which we might give attention on a rational basis.

Just to mention a few:

- We must establish an accommodation between environmental concerns and availability of energy. Almost everything we are trying to do to slow down environmental degradation results in depletion of fuel supply.
- We must take account of the economies to be effected by transporting oil in supertankers and provide adequate port facilities.
- We must increase refinery capability. If we do not offer sufficient inducement, or if we provide unjustified environmental constraint to the siting of refineries, we will not only be depending upon foreign sources for crude oil but also for refined petroleum products. The economical and potential interruption implications of this eventuality are not very attractive.

Price regulation and the tax structure must also be given appropriate attention. The present natural gas shortage appears to have resulted from stringent control in both areas. Artificially low prices and other imposed regulations have discouraged investment. An effective national energy policy program for the long term would seem to require some restructuring of price and tax subsidy provisions of our law.

Finally, our energy management at the national level requires serious attention. There are now over 60 agencies which deal with energy problems in one way or another. Obviously this is neither efficient nor desirable.

Energy and the Automobile

This presentation would not be complete without comment on energy used for transportation—25 percent of the nation's total annual consumption of power. The passenger automobile dominates the transportation sector as the principal consumer. All of us have been made aware of the potential constraints which will evolve if we are forced to restrict the consumption of gasoline.

How did this situation evolve? Less than a decade ago, our principal goals in providing personal transportation followed the classical pattern of man's progressive demand for mobility. Suddenly there was realization that some compromises would have to be made to preserve the environment and to provide a higher level of vehicle safety. No more than one year ago, these latter two criteria were compounded with a dramatic discovery in this country that we could no longer proceed with the existing assumption that oil and thus gasoline would be forever cheap and plentiful. Now we must face new challenges as we strive for both mobility and a healthful environment.

These concomitant problems facing the use of personal transportation have now entered the political arena. The proposed solutions range from increased taxation on gasoline through development of more mass transit capability, and to the ultimate threat, gasoline rationing!

For the automotive industry, all of these potential constraints and developments are taken seriously. In reality, General Motors can be said to be in the transportation business. GM builds coaches which transport people who now choose the bus for going to work or to another city. And GM also builds Diesel locomotives which provide commuter service. Improvements in both these products are constantly under way, and GM is prepared to continue to participate and contribute to developments in mass transportation.

On the other hand, we are painfully aware that our principal product, the American automobile, is a target of abuse because of its relatively high propensity for gasoline consumption.

It is no secret that a lighter and smaller car will consume less fuel than its heavier, higher power counterpart. It is also a matter of record that Diesel engines are more economical on fuel than gasoline engines of the same size. But the development of the automobile in this country has not followed the pattern of either small size or Diesel power.

It has been the predominant individual American desire to choose from among hundreds of models a high performance and generous vehicle, both in size and comfort. The automotive Diesel engine has not gained popularity because, at its present state of development, it does not provide the flexibility, silence and performance for its size that are more easily obtained with the gasoline engine.

As for vehicle weight and gasoline economy, the recent developments in safety and emissions control have both run counter to improved fuel economy.

There is no question that the new incentives, embodied in the implications of our energy supply situation will have a major impact on the design of our future cars now in the development stages.

With these new criteria, General Motors has become critically aware of the necessity for development of cars which can provide better fuel economy, and is working toward vehicles which will preserve as much of the comfort and performance as is consistent with emissions, safety, size and fuel economy. GM is hopeful that it will be able to provide such vehicles in the future through priority programs in weight reduction, transmission modification, optimization of air conditioners, adoption of new tire construction materials and adaptation of modified or alternative powerplants. Improvement in some areas can be accomplished in the near term—others, only in the more distant future.

As America gears up to the task of turning out new technology to meet its energy needs, which it must do if this country is to maintain a vibrant economy and remain as a leader among nations, all of us should be cautioned against overpromise and not foreseeing new developments in light of environmental and health concerns.

Regardless of how we at GM anticipate and attack the problems, or how soon a national energy policy is established, the period between now and 1980 or 1985 will be critical. During this period, we will apply our effort and capability to produce products meeting the sometimes divergent constraints of energy supply and environmental conservation—and still supply the products that our customers want and can afford.

Discussion Period

In response to a question asking what could be done to reduce U.S. energy demands, Mr. Starkman replied that it is easier to control things than people. For instance, better control over energy use in automobiles as well as better control over energy use in residential applications (insulation, etc.) may seem quite trivial but can result in substantial economies if joined together. Mr. Starkman stated that the emphasis and impetus will be to do a better job on the engineering side. He cited the fast breeder reactor and other nuclear methods of producing energy as ways of meeting the demand while conserving natural non-renewable sources.

A question was asked whether General Motors is proposing alternate 1975-76 emission standards to take into account fuel economy in the near future. Mr. Starkman responded that General Motors is not in agreement with the levels of the emissions prescribed for automobiles. He stated that they are too stringent, and that there are other alternative levels to which vehicles can be controlled which are satisfactory to protect health, yet which will allow improved fuel economy.

It was asked if there is the possibility of depleting the world's oxygen supply, caused by the increasing number of cars and less efficient engines, etc. Mr. Starkman responded that there is general agreement in the scientific community that nature is keeping a good balance in this area, and there is little danger of depletion.

Asked if GM has any assurance of fuel supply so that its plants could continue in operation under the present circumstances, Mr. Starkman responded that GM has thus far been able to anticipate the areas where shortages might develop, and with that anticipation, has managed to survive any shortage which has occurred. GM's energy management group attempts to anticipate shortages, to set aside supplies for such situations where GM cannot obtain normally supplied fuel, then to substitute with alternatives and finally, to provide storage space. Mr. Starkman indicated that if the Corporation does an adequate job in this area, production will not be interrupted because of either temporary shortages or a long-term shortage of any particular fuel presently being used.

In reply to a question concerning how GM presents its cost-benefit analyses on safety or emission devices to Congress and other legislative bodies, Mr. Starkman said that GM is continually called upon to provide information to the Federal Government and many of its departments. The most prominent of these was performed by a White House group called RECAT—Regulatory Effect on the Cost of Automotive Transportation. This particular group's mission was to determine what would be necessary for the auto industry to do to meet 1976 emission and safety requirements

and what would be the probable costs of those items. Mr. Starkman cited another cost-benefit study now being conducted by the National Academy of Sciences Committee on Vehicular Emissions, working under the instructions of Congress. He added that other groups, some working for the Department of Transportation, are completing similar cost-benefit studies and the community is awaiting their publication.

UPDATE ON GM RESEARCH LABORATORIES EXPANSION AND INTRODUCTION TO DISPLAYS

Dr. Paul F. Chenea

DR. PAUL F. CHENEA *joined General Motors in 1967 as Scientific Director of the Research Laboratories and became Vice President in charge in 1969.*

Dr. Chenea received a B.S. degree from the University of California in 1940 and an M.S. degree in 1947 and a Ph. D. degree in Engineering Mechanics in 1949 from the University of Michigan. He was an associate professor of Engineering Mechanics at the University of Michigan when he left there in 1952 to become head of the Division of Engineering Sciences at Purdue University. He became Assistant Dean of Engineering at Purdue in 1953 and other subsequent assignments at Purdue included Associate Dean of Engineering, head of the School of Mechanical Engineering and acting head of the Division of Mathematical Sciences. He was visiting Webster professor at Massachusetts Institute of Technology in 1958 and 1959. Dr. Chenea was named Vice President for Academic Affairs at Purdue in 1961 and was serving in that position when he joined General Motors.

Dr. Chenea is a Fellow of the American Academy of Arts and Sciences and the American Society of Mechanical Engineers. He also is a member of many engineering, scientific, and educational societies, including the National Academy of Engineering. He has written numerous technical publications and is the recipient of five honorary doctorate degrees.

We hope that this morning's presentations have served to acquaint you with major General Motors' programs and concerns—particularly in the areas of occupant restraint systems, industrial pollution, and automotive emission control. We also trust that you now have a better understanding of the growing U.S. energy crisis and its implications for GM.

GM Research Expansion

Over the next hour or so, we would like to show you some exhibits on current projects.

But before I mention some of those to be covered, I would like to call your attention to an anniversary. Just one year ago, at our last Institutional Investors Conference, GM Chairman Richard C. Gerstenberg announced that a major five-year expansion would be getting under way at the Research Laboratories.

If you were here then, you may recall him saying that the expansion was recommended by our Science Advisory Committee and that it would involve a 50 percent increase in our professional staff of scientists and engineers.

This five-year program, which also includes plans for several new buildings, was established for one major reason: to enable GM to cope more effectively with the problems of tomorrow.

Today, you can see evidence of our expansion; new roads are going in and our first new building is going up.

In keeping with the recommendations of the Science Advisory Committee, we are adding to our professional staff and, what's more, we are recruiting what we consider to be the high achievers. We are seeking those people who have demonstrated nimble minds throughout their academic training and on their previous jobs.

Some of our new employes are promising young scientists—among the best from recent college graduating classes, holders of advanced degrees. Others are proven professionals whose achievements lead us to believe they will make good leaders.

And, plainly, outstanding leaders will be a must as we explore areas where we previously had little or no expertise—in biomedical research, in the behavioral sciences and in urban analysis.

With this build-up and utilization of new talent, GM Research will become better able to cope with those problems of tomorrow. By the time our five-year expansion period ends, we will be large enough and flexible enough to handle a far wider array of projects.

The Science Advisory Committee continues to monitor General Motors operations with a critical eye. At this moment, it is analyzing the other technical organizations within GM. It seeks to determine how these Divisional and Staff groups can best serve the Corporation, as well as how the Research Laboratories might better serve them.

As before, we welcome the ideas and recommendations of the Science Advisory Committee, confident that its suggestions will show the way to further improvement in our overall capability.

Displays

In the year since we last met with you, General Motors has been moving ahead in several important areas. Today, we would like to present some evidence of our progress in the form of 10 technical displays.

Two of the displays are devoted to expanding your knowledge of catalysts and catalytic control of exhaust emissions. One display briefly explains the characteristics and functions of catalysts, while the other shows a cutaway view of an engine and exhaust system utilizing a catalytic converter.

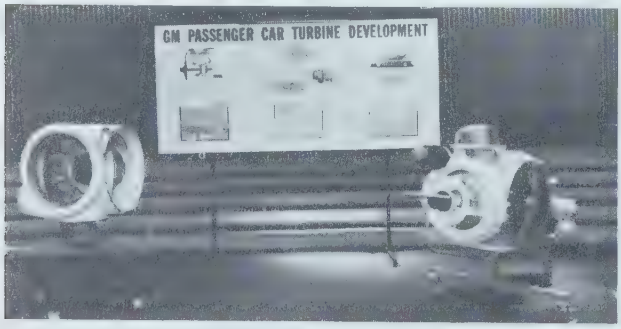
Next, there is a display of a number of alternate power sources. You may be interested to know that our scientists and engineers have evaluated more than 334 proposals on alternate methods of power sourcing. Today, you will see a small sample of these 334 engines including a dilute combustion engine, and steam, Stirling and battery engines. There also is a display dealing with the rotary combustion engine development program. This exhibit will provide some basic comparisons of the rotary engine with the conventional internal combustion piston engines.

As for engines in the preliminary development stage, you will see a display dealing with our efforts in turbine engine development for passenger car use. Also, there is a demonstration of a "slow fill" GM air cushion restraint system vehicle and a display on the current required 1974 seat belt system.

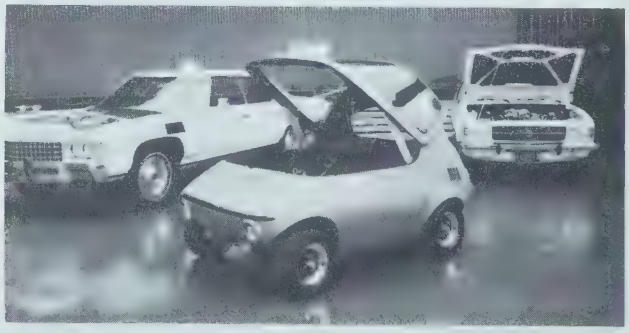
In addition, GM Overseas Operations will display its basic transportation vehicle, the one designed for use in developing countries. This display will include photographs of the vehicle being assembled and operated in these countries. You will also view displays on GM's contribution to mass transit and on the recycling of steel scrap in GM plants.

At each display a GM scientist or engineer familiar with the project will briefly explain what is being shown and will answer whatever questions you might desire to ask.

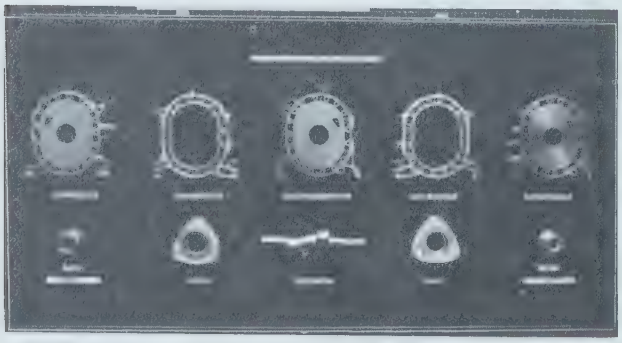
(The presentations made at the 10 displays, and the discussion following each presentation, appear on pages 41-63).



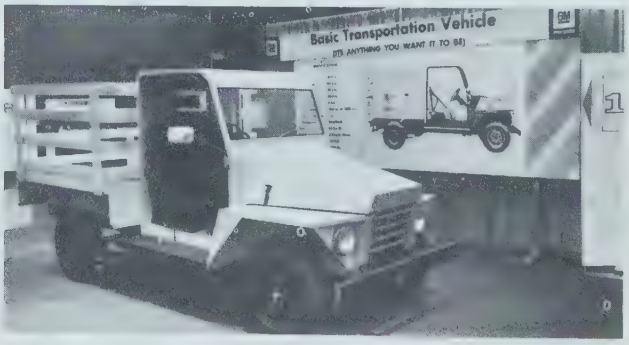
Gas Turbine Engine Display



Alternate Power Sources Display



Rotary Engine Display



Basic Transportation Display

ALTERNATE POWER SOURCES

Dr. William G. Agnew
Technical Director, Engineering/Research, GM Research Laboratories

General Motors studies of alternate powerplants for automotive use have been going on for as long as there has been a General Motors. These studies have been aimed at finding and developing the best powerplant for the automotive transportation job that needs to be done. By "best" I mean best in terms of effectiveness, efficiency, convenience, and environmental side effects.

We believe it is our responsibility to uncover every conceivable useful powerplant, inside or outside GM, and take whatever measures are necessary to evaluate its potential.

Since 1963, we have made technical reviews of 334 alternate powerplant proposals. The trend has been rising in recent years. The display here shows just a sample of some of the powerplants we have looked at.

Doing this job properly requires a logical evaluation procedure by competent professional people—and we believe this is a positive approach. We give the inventor the benefit of the doubt at every step. But when a proposal makes it all the way through these steps, we know it is worthy of a real experimental program.

Experimental programs have evolved from this kind of analysis—experimental programs that we have carried out either here at the Technical Center or by supporting programs outside of GM. For example, our steam engine and Stirling engine programs involved the construction and evaluation of complete experimental vehicles. After detailed evaluation, we concluded that neither the SE-101 steam car or the Stirlec engine-electric hybrid powerplants were suitable for passenger cars.

Diesel engines remain a possibility for passenger cars. The Opel car on display has a Diesel engine in it which our German subsidiary just introduced in 1973 production. This vehicle is not being sold in the U.S., but it offers us a convenient test bed for trying to develop an acceptable, low-emission, passenger car powerplant for domestic use.

We feel that electric vehicles probably have a role to play in a future transportation system and the dual battery car, the electric urban car, and the fuel cell-powered Electrovan are some of our experiments along this line.

The gas turbine also looks like it may be a possibility for some transportation jobs. As a heavy duty truck and bus engine, it is nearing production at our Detroit Diesel Allison Division, and a large research and development activity is underway to see if we can make it a passenger car powerplant as well. The GT-225 gas turbine engine, installed in a Chevrolet on display, is our research test bed for this program.

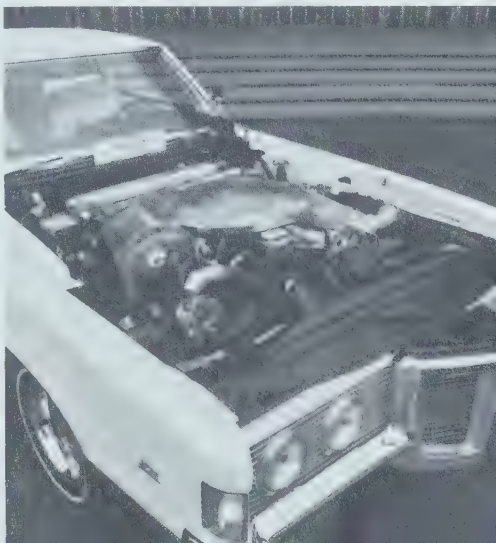
Finally, it must be remembered that one of the strongest contenders in the competition for future automotive powerplants is the spark-ignition gasoline engine itself. This engine has been evolving over many years, and it continues to improve today. Advanced emission controls, the rotary combustion engine, and various modifications of the engine, like dilute combustion, are developments that could all bring about many more years of useful life for the spark-ignition gasoline powerplant.

On the other hand, it seems quite possible that in the future we will have a greater variety of different powerplants filling a variety of different roles in our transportation system. We intend to be ready for that.

GT-225 Gas Turbine Engine

XEP-1A Dual Battery Car
(Zinc-Air, Lead-Acid Hybrid)

SE-101 Steam Car



Discussion Period

In response to a question on the Diesel engine emission levels, Dr. Agnew replied that the Diesel is low in hydrocarbon and carbon monoxide emissions, but the oxides of nitrogen are still high. He said that it appears that the Diesel cannot come close to the 1976 oxides of nitrogen standard. Dr. Agnew further stated that the Diesel is a heavy engine and when it is scaled up in power from the range of vehicles common in Europe, it becomes difficult to fit into the engine compartment. He stated that in Europe one of the major attractions of the Diesel is its fuel economy since fuel prices are somewhat higher there. Dr. Agnew also noted that the Diesel is an expensive engine and difficulties can occur with smoke, odor and noise.

In regard to a question concerning the problems with an electric car, Dr. Agnew stated that it presently has range and performance limitations. He noted that breakthroughs are needed in battery technology and in the fuel cell where improved catalysts are required to reduce emissions to required levels.

In reply to the question on the Stirling engine, Dr. Agnew replied that this engine is based on a different cycle. It is an external combustion engine, like a steam engine, with the fuel being burned outside the engine in a burner such as in a furnace, and the heat being transferred into the gas in the cylinder. The gas normally used is either hydrogen or helium.

Responding to a question on the turbine engine, Dr. Agnew stated that the turbine meets 1976 standards for hydrocarbons and carbon monoxide and while oxides of nitrogen emissions remain a problem, GM expects progress in this area. As to the reason that the turbine engine is just being used in trucks rather than cars, Dr. Agnew noted that the turbine gets its best economy when the engine is fully loaded and that the acceleration factor is less critical in trucks.

GAS TURBINE ENGINE

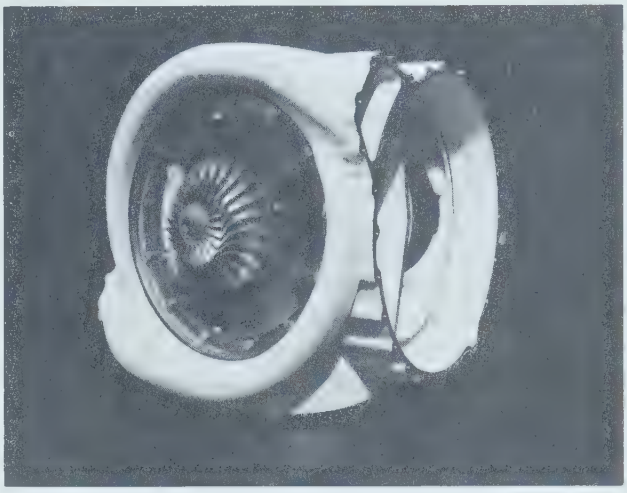
Albert H. Bell, III
Director, Engine/Transmission Passenger Car Turbine Development, GM Engineering Staff

The gas turbine engine has the reputation of being a low polluter. This is very true when one looks at the unburned hydrocarbons and carbon monoxide. However, with respect to oxides of nitrogen, the conventional gas turbine still has a problem in meeting the 1976 Federal emission requirements.

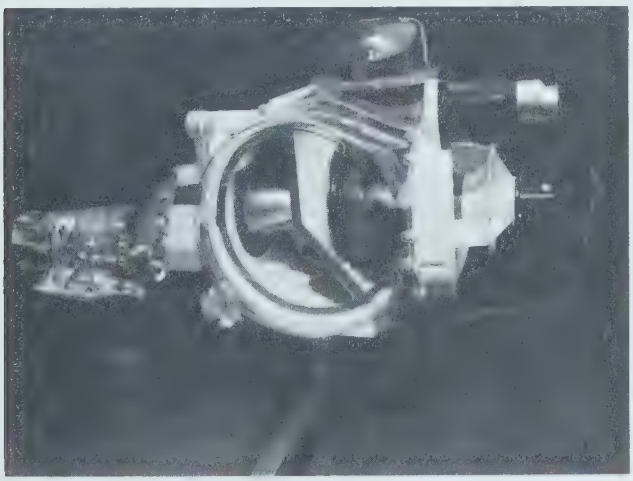
General Motors has an intensive program to modify the combustion system of the gas turbine engine to reduce the formation of oxides of nitrogen. Experimental work on a steady state combustion stand has given us some very encouraging results. By "steady state" we mean a car going down the road without changing the power levels or speed. This, of course, does not represent the way a normal car operates. These results must, therefore, be considered very preliminary because steady state test stand work does not simulate the dynamics of a vehicle.

The new combustors are significantly larger than those used in the conventional gas turbine engine of the past. Since the results are so encouraging, we are currently developing new powerplants capable of utilizing these larger, low emission combustors. Following the powerplant development, they will be installed in passenger cars where the results of this total activity must be measured and verified. While these results are encouraging, it is only after we can put the engine in a car that we can measure the emissions of the total vehicle system.

At the present time, we are starting to bring together the pieces of our new powerplant. A plastic model of this powerplant shows a standard transmission housing. The engine will use a virtually standard Turbo Hydra-matic transmission. In regard to air flow through the engine, the air first flows out from the compressor to the sides of the engine where it then turns and flows in through the regenerators. These regenerators rotate very slowly picking up heat from the exhaust and carrying that heat around to the incoming cooler, compressor discharge air. The regenerator, thereby, cools the exhaust and keeps us from having to add so much fuel in the combustor. The large combustor is located in the engine housing between the two regenerators. Following the air's passage through the combustion chamber, it flows through the first stage nozzle where it is directed against the first stage, or gasifier turbine wheel, which drives the compressor. Behind the compressor turbine is the power turbine which drives through a reduction gear and into our near standard Turbo Hydra-matic transmission.



Front—Gas Turbine Engine Model



Gas Turbine Engine Plastic Model

These are the primary elements of our gas turbine powerplant. We are presently in that phase of development following the gas turbine work done by the General Motors Research Laboratories. There is still a big job to be done in this development phase before the engine would be ready for any limited prototype production. This powerplant must be considered as being strictly in the future.

Discussion Period

In reply to a question about the operating temperatures of the turbine engine, Mr. Bell stated that in the primary zone of the combustor, temperatures can reach 4,000°F. These temperatures are then reduced to less than a 2,000°F level which is normally considered the maximum operating temperature of the engine. The exhaust gas, however, is fairly cool because the regenerator saves most of the heat and returns it to the cycle. The heat rejection in the exhaust is about the same as that rejected in the radiator air and piston engine exhaust.

When asked how GM is reducing the oxides of nitrogen emitted by a turbine engine, Mr. Bell stated that at normal turbine operating temperatures, oxides of nitrogen are not formed. He noted that in the conventional gas turbine, high temperatures in the primary zone of the combustor promote the formation of oxides of nitrogen. GM's program to reduce oxides of nitrogen consists of preventing their formation by investigating various means of controlling high temperatures in the combustor.

An individual asked when the turbine engine would be ready for production. Mr. Bell stated that this engine is in the development phase and work is being done to meet the 1976 emission standards. However, the work now being done must still be verified in an automobile and this development program could perhaps take a number of years before it is completed. Therefore, Mr. Bell noted, the engine must be considered a long-term development possibly available in the 1980's.

When asked about start and stop characteristics, Mr. Bell replied that the response of the engine to the throttle is a little different from the present reciprocating engines but that testing is being conducted to reduce these differences. In reply to a question concerning fuel economy, Mr. Bell indicated that the turbine would be comparable with present engines.

Another individual asked what type of material is being used in the turbine engine and also the regenerator. Mr. Bell stated that most materials are of iron and aluminum alloys in the engine and that the high temperature rotary parts of the engine are nickel-based alloys. The regenerator is fabricated from thin stainless steel shim stock. An individual asked at what speed the turbine engine operated and Mr. Bell replied that the gasifier shaft operates at from 22,000 to 44,000 RPM.

ROTARY COMBUSTION ENGINE

Thomas R. Zimmer
Staff Engineer, Chevrolet Motor Division

During the past year, the rotary combustion engine has continued to generate a great deal of excitement and interest in the automotive world. The increasing popularity of rotary engine-powered Mazda vehicles here in the United States is indicative of the reception this new engine is receiving.

At General Motors, our activities reached a point where the further evaluations necessary to complete our assessment of this engine had to be done in a production organization. Therefore, on August 28, 1972, R. C. Gerstenberg, Chairman of GM, announced that the responsibility for the ongoing design and development of the rotary engine was being transferred from the Special Product Development Group to the Chevrolet Motor Division. He also indicated that initial rotary engine production will be done at the Hydra-matic Division plant in Ypsilanti, Michigan. Engine development and manufacturing processing will continue and, if this progresses as anticipated, public introduction of the engine may be made on a 1975 model in the small Chevrolet line.

The factors which make the rotary engine attractive are: size, weight, manufacturing flexibility, and operating characteristics.

We are interested in the potential manufacturing flexibility of the rotary engine because it readily adapts to the production of a family of sizes from a given set of tooling. This increases the value of any investment in tooling, and gives us more flexibility in the marketplace. Since the automobile market is volatile and difficult to predict, greater flexibility is always an advantage.

As to the operating characteristics, the quietness and smoothness of the rotary engine are, indeed, desirable factors.

The most attractive features of the rotary engine, however, are the fact that it is 50 percent smaller and 30 percent lighter than a comparable piston engine. It opens up new avenues of powerplant configuration and vehicle packaging. These advantages will not be realized until we are satisfied that the engine is reliable on the basis of volume and the economics normally associated with our industry.

When talking about the characteristics of the rotary engine, a word about emissions is in order. There have been claims that the rotary engine is a dirty engine or that it is a clean engine and that because it is clean, it offers advantages in meeting future emissions standards. The facts are that when compared to a piston engine, the rotary engine is now, and probably always will be, a slightly higher emitter of hydrocarbons. It is equivalent to the piston engine in terms of carbon monoxide, and has comparable or slightly lower levels of oxides of nitrogen emissions.

Because the projected demands of the Clean Air Act will probably require today's piston engines to use some type of external device to control emissions—such as a catalytic converter or thermal reactor—these differences are greatly minimized. Further, the size and weight advantages of the rotary engine help significantly in offsetting the installation of these devices. Also, the lesser number of exhaust ports makes some of these devices simpler in design and application.

During the past year, General Motors has produced over 75 rotary combustion engines of our own design for test and development purposes. To a large extent, these engines were made on prototype tooling at the Hydra-matic Division so that we could gain manufacturing experience as well as the engineering experience necessary to develop the engine. For this reason, we feel that our manufacturing technology, at this point, is equal to our product technology.

In carrying out this program many allied and outside suppliers have been called upon to investigate various problems with us. This, of course, had led to a great deal of speculation as to when we will introduce a rotary engine, and who will be involved in our program.

The fact is that General Motors is still very much involved in the development of the rotary engine and there are a number of problems and questions that must be resolved before we feel it is ready for production. However, we are encouraged and satisfied with our progress to date and feel that we are still on schedule relative to the objectives implied in Mr. Gerstenberg's statement.

Discussion Period

An individual asked what the Corporation was receiving in return for its license payments. Mr. Zimmer replied that GM had bought the rights to produce rotary engines anywhere in the world under the licensors' patents and "knowhow" with the single exception of aircraft propulsion. Mr. Zimmer further noted that if engineering and manufacturing development progressed as anticipated, public introduction of the engine as an option might be made in about two years.

In response to a question as to the advantages of the rotary engine, Mr. Zimmer stated that by far the greatest advantages of the engine are its size and weight. Mr. Zimmer also noted that the power output of the rotary engine is about 10 percent to 15 percent higher than for a piston engine of comparable displacement due primarily to the higher engine speeds in the rotary engine.

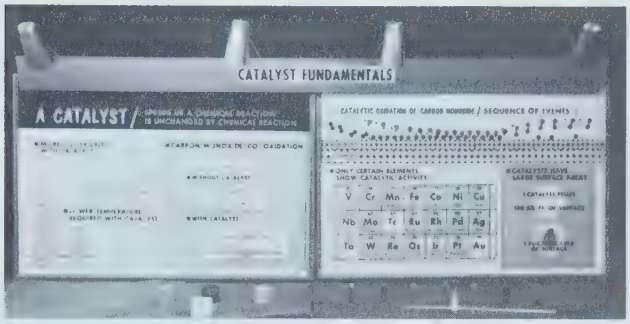
A question was asked as to whether the rotary engine would be cheaper than the conventional piston engine. Mr. Zimmer indicated that initially the rotary engine would not be, but that in the future the engine may offer economic advantages. In response to a question on maintenance, Mr. Zimmer indicated that ultimately the maintenance cost of the rotary engine should be lower than that of a piston engine.

Another questioner inquired as to the fuel economy of the rotary engine compared to a reciprocating engine. Mr. Zimmer responded that GM believes it has the technology to obtain fuel economy with a rotary engine equivalent to that of a reciprocating engine. Fuel economy of the GM rotary engine will depend on emissions system requirements and engine durability and reliability demands. Formulation of an emissions treatment package for the rotary engine capable of meeting the projected 1975 and 1976 standards is a major problem at this point.

In reply to a question concerning the seals on the rotary engine, Mr. Zimmer said that GM believes there is no fundamental sealing problem. Currently, GM is looking at many different types of seal material such as ceramics, graphitics, and metallics and test samples are being submitted by many different potential suppliers.

CATALYST FUNDAMENTALS

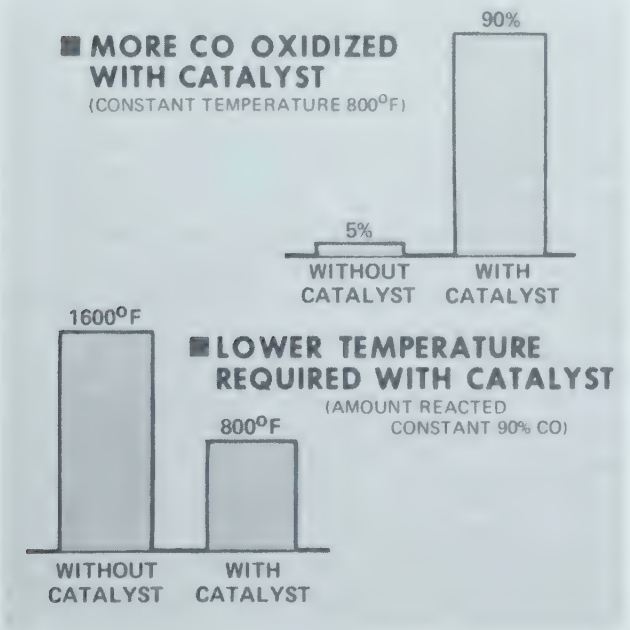
Dr. Charles S. Tuesday
Head, Environmental Science Department, GM Research Laboratories



Emission control systems containing catalysts seem to offer the best promise for meeting future automotive emission requirements. Thus, catalysts may soon become a part of every General Motors car and, hence, an important part of General Motors business. We thought, therefore, that you might appreciate knowing something more about catalysts in general—what they are, what they do, and how they work.

A catalyst has two fundamental characteristics. First, it is able to make a chemical reaction go faster, and, second, although it enters into the chemical reaction, it emerges unchanged—able to repeat the process again.

The ability of a catalyst to speed up a chemical reaction is illustrated below. Carbon monoxide

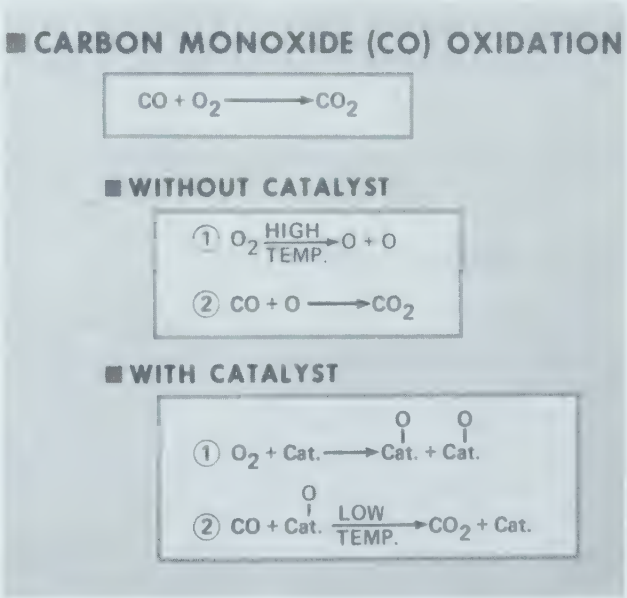


(CO) is one of the constituents of automotive exhaust that must be reduced still further in order to meet future emission standards. If air is added to the exhaust, and we consider a constant temperature of 800°F, only a small amount of CO is oxidized to carbon dioxide without a catalyst at this temperature. When the right catalyst is present, however, almost all of the carbon monoxide is oxidized.

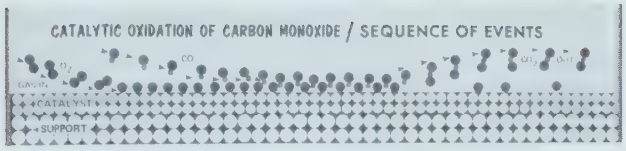
This same effect can be seen in another way. Increased temperature also makes reactions go faster. A temperature of 1,600°F would be required without a catalyst to oxidize the same amount of CO that is oxidized at only 800°F when a catalyst is used.

Thus, catalysts allow emission control systems to operate at lower temperatures, avoiding both the materials and increased fuel usage problems of high temperatures, and, at the same time, giving better emission control.

The ability of catalysts to reduce reaction temperature requirements can be illustrated conceptually using the carbon monoxide oxidation reaction as an example. Without a catalyst, high



temperatures are required to dissociate oxygen to form atomic oxygen which, in turn, reacts rapidly with CO to form CO_2. When the right catalyst is present, however, oxygen is adsorbed on the surface of the catalyst and, in the process, is dissociated into adsorbed oxygen atoms. The reaction of these adsorbed oxygen atoms with CO to form CO_2 occurs at lower temperatures, and the catalyst emerges unchanged, ready to repeat the process again.



This sequence of events can be explained as follows. The first thing that occurs is the adsorption of oxygen on the surface. Then, CO is also adsorbed on the surface of the catalyst. If conditions are favorable—that is, the right catalyst is at the right temperature—the adsorbed oxygen and CO unite and leave the surface of the catalyst as CO_2. The catalyst surface is again bare and ready to repeat the process.

Since the surface of the catalyst actually enters into the reaction, special efforts are made to give catalysts large surface areas. Emission control catalysts are usually either in the form of pellets or in a unitized monolithic structure. In either case, the catalyst consists of a relatively porous substrate of an inert material, such as alumina, on which small amounts of the catalytically active material are deposited.

Only a few chemical elements have this type of

■ ONLY CERTAIN ELEMENTS SHOW CATALYTIC ACTIVITY

23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper
41 Nb	42 Mo Molyb-denum	43 Tc	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver
73 Ta	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au

catalytic activity. These elements are generally in the middle of the Periodic Table and many of these are the rare, precious metals such as platinum and palladium.

The resultant catalyst has a large surface area on a molecular scale. One pellet, for instance, can have a geometric surface area of only ¼ square inch, but because of its relatively porous structure it has a molecular surface area of over 100 square feet. It is this large surface area which makes these catalysts so active and so useful for automotive emission control.

Discussion Period

In response to a question as to how there can be so much surface area in the solid looking pellets, Dr. Tuesday responded by stating that the pellets only look solid. To a carbon monoxide or oxygen molecule, the pellets are rather open structures filled with cracks and crevices and the surface area referred to is on a molecular scale.

The factors which cause deterioration of a catalyst, Dr. Tuesday said, are two. The first factor involves high temperatures, which tend to shrink that all-important high surface area. The second type of deterioration involves catalyst poisons, such as lead and phosphorus, which might be in the gasoline and which tend to cover up the surface of the catalyst, thereby rendering it inactive.

Another individual asked what metals are going to be used in these catalysts. Dr. Tuesday stated that GM has done research and development on both precious-metal and base-metal catalysts. Current very low emission requirements and timetables have necessitated utilizing the most active and durable catalysts available. Platinum and palladium promoted catalysts are currently the most effective catalysts for emission control.

In response to a statement that the use of platinum and palladium make GM dependent on foreign sources, Dr. Tuesday responded that this definitely was the situation. The major deposits of platinum metals are located in South Africa and the Soviet Union. A further question was asked as to whether catalysts could be regenerated or platinum recovered, to which Dr. Tuesday replied that GM is examining the possibility of catalyst regeneration. Dr. Tuesday went on to state that while platinum and palladium can certainly be recovered, the cost of collection and recovery would be considerable.

Asked if the same catalyst can work for carbon monoxide, hydrocarbons and oxides of nitrogen, Dr. Tuesday explained that the same catalyst—an oxidation catalyst — is used for both carbon monoxide and hydrocarbons, which require oxidation reactions to be removed. Oxides of nitrogen control require a reduction reaction and usually a different catalyst. Oxides of nitrogen catalyst development is lagging behind carbon monoxide-hydrocarbon catalyst development.

50 CATALYTIC CONVERTERS

George W. Niepoth
Executive Engineer, Advance Product Engineering, GM Engineering Staff

A major General Motors effort in attempting to meet the 1975 and 1976 Federal emission requirements has been the development of a catalytic converter exhaust control system. The Federal exhaust emission standards represent the targets for our emission system development.

FEDERAL EXHAUST EMISSION STANDARDS
GRAMS PER MILE

	HC	CO	NO_x
1960 (Precontrol Car)	15.0	90.0	5.0
1973	3.0	28.0	3.1
1975	0.41	3.4	3.1
1976	0.41	3.4	0.4

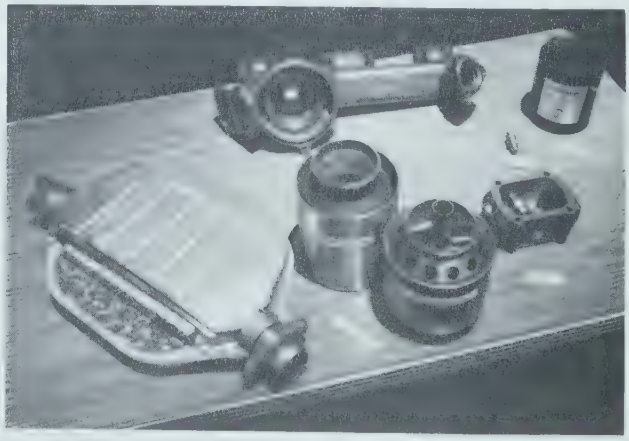
The 1973 standards, to which our current model cars were certified, represent a substantial reduction in emissions from the precontrol car. The 1975 standards require a further major reduction in hydrocarbons (HC) and carbon monoxide (CO). We feel an oxidizing catalytic converter will be required to approach these standards. In 1976, oxides of nitrogen (NO_x) must be reduced to 0.4 grams per mile. A reducing catalytic converter appears to be required to meet these standards. GM is currently investigating several catalytic converter approaches. One system—called a T-MECS catalytic converter system—uses a catalyst located in the exhaust manifold of the engine. The system is being designed in an attempt to meet both the 1975 and 1976 Federal requirements. In 1975, an "oxidizing only" catalyst will be used to control hydrocarbons and carbon monoxide.

Catalytic Converter System

1976 Emission Control System

In 1976, the oxides of nitrogen requirements are reduced from 3.1 grams per mile to 0.4 grams per mile. This very low NO_x requirement necessitates the use of an NO_x catalyst, so the system then becomes a dual catalytic converter system. In this case, half of the catalyst in the container would be oxidizing and the other half would be reducing for control of NO_x. A converter-reactor valve located in the exhaust manifold beyond the catalytic converter protects the catalyst during a malfunction of the engine, or high speeds and loads. At high speed and load operation, the exhaust manifold acts as a reactor. The purpose of locating the converter in the exhaust manifold is to give quick "light off" of the catalyst on a cold engine start and to give somewhat higher operating temperatures in an attempt to minimize contamination and to maintain good operating characteristics of the catalyst.

In addition to the catalytic converter, many other components are necessary to make the overall emission control system work. The other components include a new carburetor that is altitude and temperature compensated and is designed to have its air-fuel mixtures relate directly to the functions of the catalytic converter system. For example, a rich mixture can be used to provide a reducing atmosphere for NO_x control in city driv-



Catalytic Converter and Related Components

ing and a leaner mixture for highway economy.

There also is an exhaust gas recirculation system valve located on the intake manifold. The passages to recirculate some of the exhaust from the engine back into the inlet system are internal within the intake manifold. The purpose of this recirculated exhaust gas is to lower the operating temperature in the engine and to reduce the oxides of nitrogen emissions from the engine. The air injection system—air pump at the front of the engine and an air control valve and associated hoses and valves—is used to deliver air to the exhaust ports of the engine to oxidize some of the hydrocarbons and carbon monoxide in the exhaust system, plus provide the required oxygen for the catalytic converter.

A quick warm up of the inlet manifold is beneficial in reducing the cold engine enrichment or choking requirements; therefore, we have what we call an EFE (early fuel evaporation) manifold with a low inertia hot plate that warms up very quickly after the engine is started and evaporates fuel from the carburetor into the air stream. The EFE control valve is located in the exhaust crossover pipe so that on a cold start all of the exhaust from the right bank of the engine is forced through the crossover to provide heat to the intake charge. After a few minutes of engine operation, the EFE control valve opens and the exhaust then can pass through the external exhaust crossover pipe to control the temperature of the intake manifold. A high energy ignition system is being used to give increased capability for firing lean mixtures and mixtures in which high percentages of exhaust gas are contained. In addition, an electronic ignition system eliminates the breaker points and gives longer performance of the ignition system without maintenance. Lead-free fuel, which is required for these catalytic converter systems, is beneficial in giving longer spark plug life and less tendency for misfiring.

1975 Emission Control System

A second catalytic converter system undergoing development is the underfloor catalyst container, shown in the exhaust pipe of the engine on display. The underfloor catalyst container has a larger volume of catalyst and is very effective in controlling HC and CO emissions, but does warm up somewhat slower because of its more remote location from the exhaust of the engine.

When this system is operated as a dual catalyst system, the reducing catalyst would be located in the exhaust manifold for NO_x control, and the underfloor oxidizing converter would provide the HC-CO control.

Simultaneous Development

Both the T-MECS and underfloor catalyst system approaches are being developed simultaneously. In addition, the tooling and manufacturing capabilities are being acquired for both systems since adequate performance and durability have not been demonstrated with either system that can allow us to make the decision between the two. The important factor in this decision is the need to determine the durability of these systems both under the idealized MVMA driving conditions used for Federal certification as well as in the field where the cars will encounter a wide variety of operating conditions that may be detrimental to a catalytic converter.

We have had a lot of experience with exhaust emission control systems since they were first introduced in California in 1966 and under Federal standards in 1968. However, the systems that we are familiar with are those which are associated with the carburetor, the air injection pump, modifications to the ignition distributor, and to the engine itself. None of this experience comprehends the factors that are involved with the catalytic converter.

Oxidizing, Reducing Catalysts

We have had some success in developing an oxidizing catalyst. Our greatest success has been with a bead type noble metal (platinum and palladium type) catalyst. This catalyst is our front runner in attempting to meet the 1975 requirements. We are attempting to develop a ceramic monolith because of the inherently lower backpressure associated with this catalyst containment system and some of the advantages as far as packaging are concerned. The system does not require metal grids to contain the catalyst and should give benefits as far as warmup of the catalyst is concerned. However, we have yet to demonstrate long term durability in this area.

On the reducing catalyst side, we have had no success in demonstrating a durable catalyst.

Monolithic or bead reducing catalysts that we have tested to date have shown potential for reducing oxides of nitrogen at zero miles with 60 to 70 percent conversion efficiencies. However, this efficiency is lost very quickly so that in less than 4,000 miles these catalysts have become deactivated. Metallic supported catalysts have shown higher conversion efficiencies, but are prone to melt. We have a major program to find an effective, durable NO_x catalyst.

Summary

The most promising system for meeting the very strict Federal exhaust emission requirements appears to us to be a catalytic converter system. We are developing two systems which appear to be the best that we have found for catalytic converter systems in an attempt to meet these requirements. Durability of the catalyst is still a major problem, and we have not at this time demonstrated a capability of meeting all of the requirements of the 1975-1976 Federal standards with our systems as they are constituted to date.

Discussion Period

In response to a question concerning the composition of the converter container material, Mr. Niepoth indicated that stainless steel was being used because of its temperature and corrosion resistance. When asked by an individual if the same catalytic material would be used in both the oxidizing and reducing converter, Mr. Niepoth said that different catalytic materials would be used.

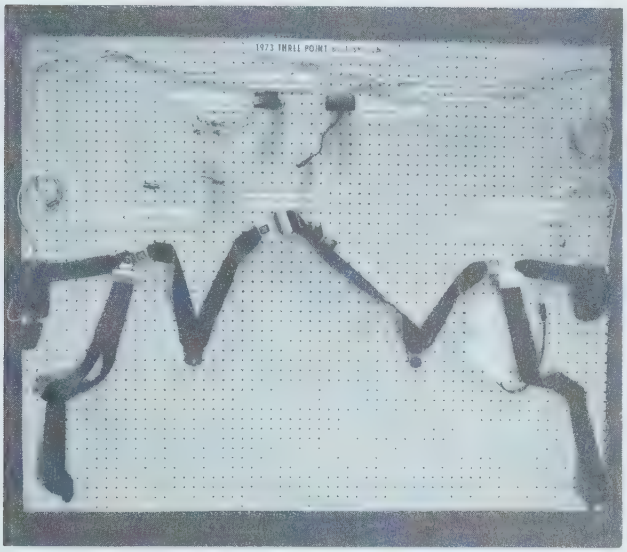
In reply to questions regarding the effects that catalytic converters would have on engine performance, Mr. Niepoth indicated that advanced emission control hardware, and catalytic converters specifically, would not have a major effect on engine horsepower. An individual asked a question regarding fuel requirements for 1975 and 1976 cars. Mr. Niepoth responded that the catalytic converter systems would require lead-free and phosphorus-free fuel. He also indicated that fuel consumption in 1975 cars should not be reduced from present levels. In reply to a question inquiring about the deterioration of fuel economy in current production cars, Mr. Niepoth indicated that some loss of fuel economy in present GM production cars was due to emission control systems while other factors such as increased vehicle weight associated with the safety and emissions equipment also contribute to lowering fuel economy.

An individual asked if the new emission control systems would be more temperamental and require more maintenance than present cars. Mr. Niepoth replied that systems presently being considered would be more sophisticated than those used in the past, and that more maintenance would be required.

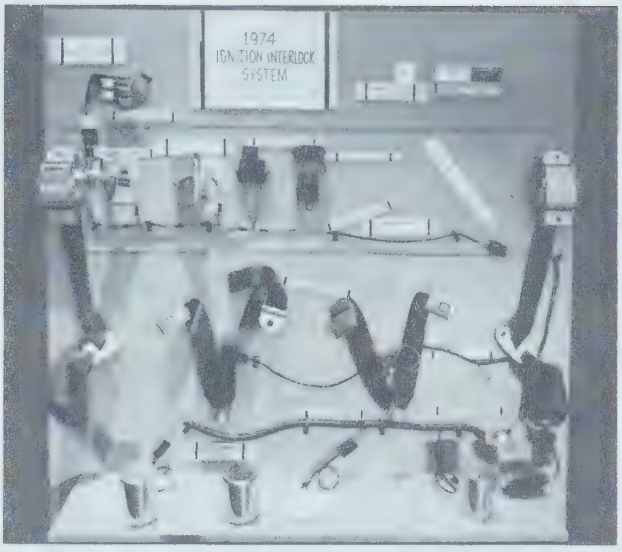
In response to a question regarding the life of underfloor and manifold mounted converter systems, Mr. Niepoth noted that indications are that no major difference between the two systems exists. He stated, however, that catalyst durability for both systems is still a major remaining problem before the successful use of catalytic converters in cars can be achieved. An individual asked how a person or dealer would know if the converter system on his car were working properly. Mr. Niepoth indicated that some kind of test would have to be developed, and that at present, proper field maintenance would be the major ingredient for assuring that the system was performing properly. In reply to a question on how emission standards will be monitored to assure that vehicles on the road are complying with emission standards, Mr. Niepoth indicated that GM recommends that the cars in the field be required to be maintained according to the manufacturer's recommendation so that the systems will be operational and repairs and maintenance are performed. To insure that this approach results in the control of automotive emissions into the atmosphere, GM also recommends the establishment of a joint industry-government testing program on vehicles in the field. If necessary, the results of this surveillance program would then be used to correct the design and certification process.

1974 SEAT BELT RESTRAINT SYSTEM

William E. Brennan
Safety Development Group, Fisher Body Division



Component Parts Display of 1973
3-Point Restraint System



Component Parts Display of 1974
Restraint System with Ignition Interlock

Electronic Logic Modules for Ignition Interlock System

1974 Shoulder Belt Retractor and Inertia Reel Location

The 1973 model car belt system consists of lap belts for all three front seating positions, shoulder belts for the two outboard positions, and emergency locking retractors for the outboard positions only. The electrical components consist of a buzzer and a warning light, both of which work through the ignition switch and the drive selector. The 1973 system requires only one seat switch.

In comparison, the 1974 restraint system also requires lap belts for all three front seating positions, but there are two shoulder belt retractors for the front outboard positions which are connected with a continuous loop seat belt and operate by one buckle. The shoulder belt retractor is "Vehicle Sensitive" and comes into play only upon quick vehicle deceleration. The 1974 system requires switches in all front seat belt buckles. In addition to the light and buzzer switch, also used for 1973, there is an override switch, a new neutral safety switch, an interlock relay, three seat switches and a sequence module. The sequence module is the electronic brain that controls the proper sequence of the total belt system.

(At this point in the presentation, an actual two-passenger condition for the 1974 sequential interlock was simulated. With a passenger and driver in the front seat—both unbuckled—it was shown that the car would not start. With the passenger buckled, but the driver unbuckled, the car still would not start. With both the driver and passenger buckled, the car could be started. Then, the transmission was placed in simulated drive. The simulation next showed that if the passenger unbuckled the belt, the light and buzzer became activated. The next demonstration simulated a condition where the driver unbuckled the belt and there was a "stall mode." It was shown that the driver could restart the car without buckling,

for safety reasons, but when the car was put in forward gear the warning light and buzzer became activated. It also was demonstrated that if both passengers exit, then reach in and buckle the belts prior to sitting on the seat, the car would not start. The final demonstration involved having interested viewers of the display sit in the passenger seat of 2 prototype cars to test the total mobility of a passenger with the shoulder belt on.)

Discussion Period

In response to a question as to whether the installation of an interlock system was required by law on 1974 cars, Mr. Brennan responded that this was the case. He also noted that the Corporation had petitioned to have the interlock system requirement rescinded due to concern over the system's reliability because of its complexity and concern over the added cost to the vehicle.

In reply to a question pertaining to the operation of the system, Mr. Brennan said that since the interlock system only has an influence on the starting system, unfastening the seat belts once the car is running will only activate the warning system and then only when the vehicle is in a forward drive mode. In conjunction with this, Mr. Brennan commented that the system can be defeated or disconnected by a skilled person familiar with the functioning of the system. For example, the car will start if the belt is fastened after the occupant has been seated or if certain wires are cut. On the other hand, cutting certain other wires will prevent proper activation of the system and prevent starting under all conditions except by usage of the by-pass switch.

A question was asked concerning the sensitivity of the seat sensors. Mr. Brennan stated that the seat sensors are pressure sensitive and will be activated by any type of weight if it is heavy enough. However, it was noted that unless this weight is quite large, it would have to be very concentrated to activate the sensors. As a result, Mr. Brennan said that many types of packages such as briefcases will not normally activate the sensors.

AIR CUSHION RESTRAINT SYSTEM

Edwin H. Klove
Senior Engineer-in-Charge, Air Cushion Restraint System, Fisher Body Division

An air cushion restraint system-equipped car has two accident-sensing devices. One is located on the front bumper, the second is mounted inside the passenger's compartment under the instrument panel. These two devices send an electrical signal to the air restraint modules located in front of the front seat occupants.

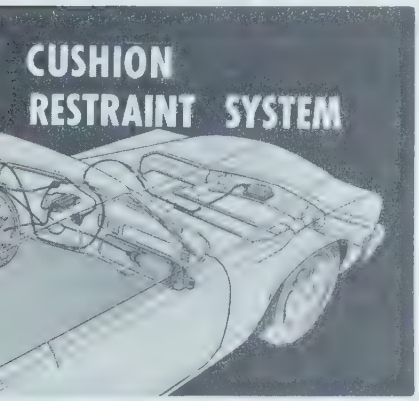
The driver's air restraint module is mounted to the steering wheel. An accident signal inflates a spherical cushion. A chemical gas generator produces the inflating energy. A metal-foam construction knee restraint pad is attached to the lower portion of the instrument panel. The steering column utilizes a new mounting and energy-absorbing collapse construction.

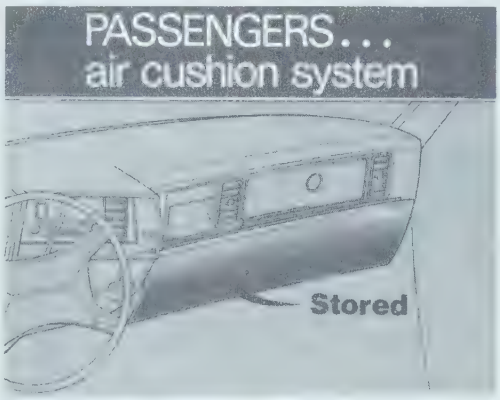
The passenger's air cushion system provides coverage for both the right and center front passengers. The basic system is positioned low on the instrument panel and to the right of centerline of the car. The glove compartment is located above the air cushion package.

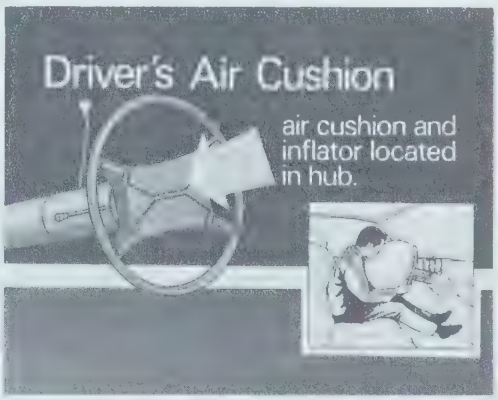
The passenger air restraint system module consists of an inflator, duct work to carry the gas to the stored air cushions, a sheet metal housing for the air cushions, the cushions themselves, and the appearance cover. The cushions deploy rearward and upward.

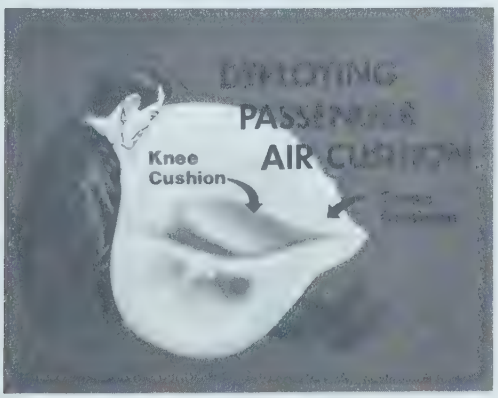
An internal knee restraint cushion fills the space between the occupant and the instrument panel. Unlike the driver, passenger occupants may be close to, or far away from, the instrument panel. The knee restraint bag accommodates these variations. The outer or torso cushion is of uncoated woven nylon construction, and extends laterally from the door to the steering wheel. In a crash situation, the occupants displace the cushion upwardly until it almost contacts the roof.

A 30 mile per hour barrier crash requires that the air cushion restraint system sense the accident, inflate the air cushion, and restrain the occupants in 125 milliseconds. Approximately 60 milliseconds of that is used to inflate the air cushion systems. The "slow inflation" system installed in the display car slows the inflation procedure down to two seconds or 35 times longer. (A demonstration of air cushion inflation followed the presentation.)









Discussion Period

A question was asked as to what had been done to insure that the air cushion restraint system would not discharge accidentally and Mr. Klove said that the system is designed with redundant safeguards to prevent accidental actuations. In addition, a number of vehicles have been subjected to a total of more than three million miles of road exposure under real life conditions using the same kind of sensing mechanisms that will be a part of the production system installation.

In reply to a question asking at what speed the system would actuate, Mr. Klove stated that the system will actuate when a car experiences a collision equivalent to a 10 to 12 mile per hour collision with a solid wall. He indicated that this is equivalent to a 20 to 24 mile per hour impact into a parked car of similar size and weight.

An individual asked about the performance of air bags in side and rear impact collisions. Mr. Klove stated that in the case of side collisions where the impact would cause an occupant to strike the instrument panel or windshield pillar equivalent to a barrier impact of 10 to 12 miles per hour or more, the system would deploy. However, if the impact is a broadside-type collision, the system probably would not actuate nor would it actuate in case of a rear end collision.

A question was asked as to the method of repairing the air bag system once it is used. Mr. Klove stated that present repair is by replacement. The inflator cannot be recharged and since the air cushion fabric is distorted, providing energy absorption, the air cushion itself must be replaced. In addition, it is felt that the whole system should be replaced to maintain a high level of reliability.

A question was asked as to what the air cushion was made of and what kind of gas it employs. Mr. Klove stated that the air bag is made of woven nylon and that the driver's system utilizes a solid gas generator while the passenger's system utilizes primarily compressed argon, the energy of which is supplemented by gas generators. Mr. Klove also indicated that the front seat air cushion system would not cause the side window glass to break upon deployment.

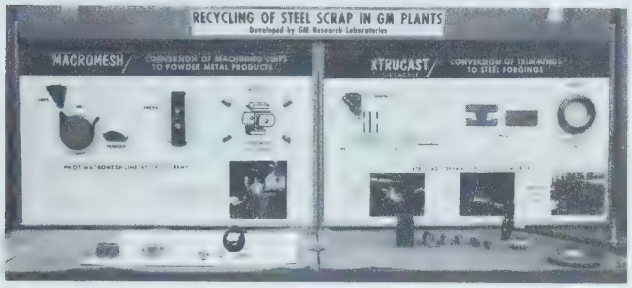
In response to a question as to how much the air cushion system would cost, Mr. Klove indicated that at present GM is not certain of the final total cost although about one year ago GM had indicated to the Department of Transportation that the air cushion system for front seat occupants might cost in the area of $145 to $160.

METAL RECYCLING

James C. Holzwarth
Head, Metallurgy Department, GM Research Laboratories

For every car that GM produces, about 1,000 pounds of scrap iron and steel leftovers are generated. The ferrous scrap from our 5,000,000 vehicles produced each year would cover a football field to a height of about 40 stories.

There has always been an economic incentive to recycle this scrap into useful parts for our products. But efforts to develop the needed technology have sharply increased as the environment and conservation of resources have become items of high national priority. Two recycling developments have already been accepted for GM production.



Metal Recycling Display

The first, called MacroMesh, is now being readied for production startup at Delco-Remy Division. Machining chips from lathe turning or drilling operations are the source material. The second recycling process, called GM XtruCast, is based on consuming all forms of steel scrap and is presently being used at Oldsmobile Division.

MacroMesh

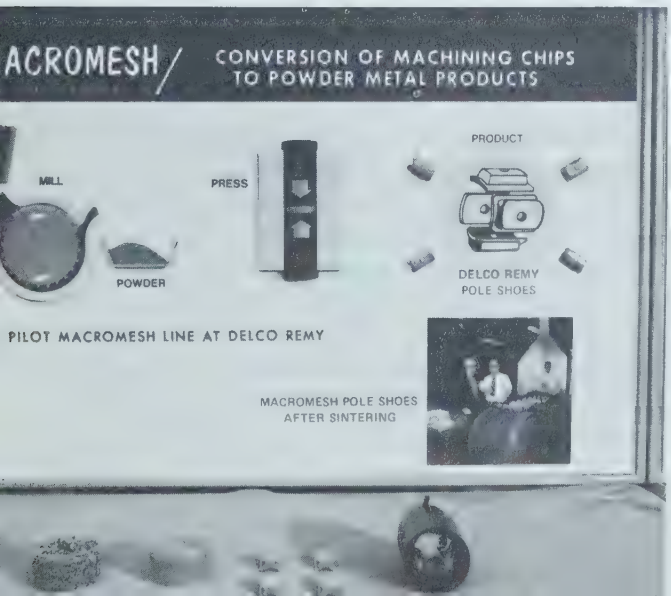
To convert machining chips into the MacroMesh byproduct, the chips are first cleaned, then crushed in a special mill to produce a coarse steel powder. This powder is then briquetted in closed dies at high pressure to form the desired shape. A heat treatment followed by a coining operation completes the part. In this instance, Delco-Remy is using MacroMesh powder to form magnetic pole pieces. There are four such pole pieces or shoes in each automobile starter motor. Pole shoes made from MacroMesh actually outperform those previously fabricated from bar stock. Essentially, all of the steel machining chips generated by Delco-Remy in its Anderson, Indiana, plants will be converted to these pole pieces for use in essentially all starter motors that Delco-Remy manufactures.

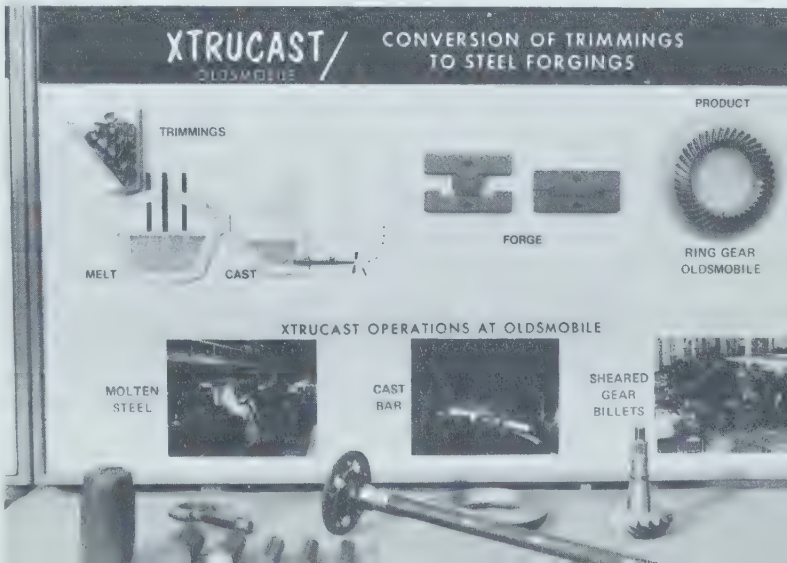
GM XtruCast Process

The GM XtruCast Process is based on new technology developed by the GM Research Laboratories. Oldsmobile Division built a plant in Lansing for the XtruCast Process that is capable of converting 60,000 tons per year of steel scrap back to high quality bar stock for forging into automotive parts. Here's how XtruCast works.

The scrap steel is first melted in electric arc furnaces. The molten steel then is transferred to a casting vessel having a special mold attached. Round bar stock is cast in a continuous strand through this mold. A broad range of bar diameters is possible depending on the end use of the bar. The secret of the whole process lies in the construction of the mold and extraction equipment.

As the bar solidifies and emerges from the mold, it is sheared to appropriate length for use as forging billets. A sheared length of bar stock then is upset to a disc shape. In the next stage, the disc is pressed to a differential ring gear blank. Finally, the gear teeth are machined on the forged part in a conventional manner. All scrap and chips from these operations are again recycled through the system.





Other candidate parts for the XtruCast recycling program are connecting rods, axles, drive pinions and differential gears.

Recycling Payoff

What is the payoff from these scrap recycling programs?

- First, they aid in the increasingly difficult scrap disposal problem.
- Secondly, they conserve a valuable natural resource, iron ore, much of which now is imported.
- Third, they reduce energy requirements—none of the materials need to be transported beyond the boundaries of the plant and no energy has to be provided for reducing iron ore to metallic iron—the steel scrap is already in a "reduced" or metallic state.
- Because of the low raw material cost, the processes are economically attractive.

While some important inroads have been made into the area of greatest concern—steel scrap—there is still considerable work going on in other areas and new technology is being developed for additional metal recycling programs. In addition, General Motors is working on internally recycling other resources such as plastics, water, cutting oils, containers and other processing materials.

Discussion Period

In reply to a question as to a program directed toward generating less scrap, Mr. Holzwarth stated that GM is continually striving for maximum utilization of its purchased steel stock due to the high price of incoming bar and sheet materials as compared to the relatively low value for steel scrap. In response to a question on the percentage of scrap presently being recycled, Mr. Holzwarth estimated that the Corporation is currently recycling approximately 20 percent of its residual steel scrap through its foundry operations. In addition, it was noted that the only limitation that affects the number of times materials can be recycled is that posed by contamination from unwanted elements which might have a deleterious effect on the desired properties of the end product, and that a careful segregation of scrap has to be maintained.

An individual asked when the GM recycling programs were introduced. Mr. Holzwarth responded that the development for XtruCast began in 1964 and that the technique was first introduced into the manufacturing processes in late 1970 and that the development of the MacroMesh technique began about 1968. Both of these programs were developed to deal only with in-house scrap.

A question was asked whether the steel industry had always used scrap, and Mr. Holzwarth replied affirmatively and indicated that most GM scrap still goes to the steel companies. However, he pointed out that an important objective of GM steel scrap recycling programs is to remove enough of the prime, better quality scrap from the marketplace, thereby providing more incentive for scrap dealers and brokers to harvest old cars, refrigerators and urban wastes.

In response to a question as to the economy of scale of GM scrap processing operations, Mr. Holzwarth commented that GM is able to run an efficient operation by casting horizontally rather than vertically, a process completely different from those used by most continuous casting operations. He further stated that the key to the GM development is the unique mold and extraction equipment that permits a prolonged casting operation, all achieved at floor level in the plant.

Responding to a question concerning the parts being made using the MacroMesh and XtruCast techniques, Mr. Holzwarth indicated that these methods are feasible for only machinery parts such as gears and not structural parts. He also indicated that material and component specifications have not been reduced in order to employ the new techniques.

MASS TRANSIT SYSTEMS

William M. Spreitzer
Head, Transportation Research, GM Research Laboratories

Mass Transit Display

Exclusive bus lanes, or the operation of transit buses on reserved lanes separate from other traffic, are now in successful operation in six cities and in various stages of planning in three more. General Motors' work and publications in the time period from 1962-1967 were a major factor in the concept of exclusive bus lanes and their present use.

Reserved bus lanes are now in operation in Washington, D. C., on the New Jersey-Lincoln Tunnel approach to New York City, in Seattle, in San Francisco, in Boston and in Los Angeles. (A film clip of the New Jersey-Lincoln Tunnel application showed how one lane of the normally outbound Manhattan roadway has been given over to inbound Manhattan bus flow in the morning rush hour, thus accommodating up to 560 buses per hour while saving 15 minutes in travel time over the previous bus trip. Automobile congestion also has been reduced.)

You may not be aware that GM's Research Laboratories and Design Staff studies in the early 1960's provided information vital to the decisions to implement such bus operations. Theoretical analyses were confirmed with extensive experiments or tests at the General Motors Proving Ground. (A second film clip showed buses being operated with untrained drivers at various speeds and under various other conditions to establish stability characteristics and bus flow potential in buses per lane per hour. Flows of over 1,400 buses per lane per hour were demonstrated at a speed of about 30 mph, and the high flow persisted over a wide speed range.)

This potential was then applied to the analysis of a 7.8 mile long East-West travel corridor in the Milwaukee Area in cooperation with the Southeastern Wisconsin Regional Planning Commission. The result was the development of the so-called "Metro-Mode" concept published by General Motors in April 1967 and distributed extensively.

General Motors also has complemented improvement in bus operations with improvements in bus design. In 1972 General Motors was selected by the U. S. Department of Transportation as one of the contractors in the so-called "TRANSBUS" design and prototype fabrication and evaluation program which may result in a new, standardized bus design.

However, General Motors' contribution to the TRANSBUS program is considerably larger, including GMC Truck and Coach Division's Rapid Transit Experimental, or RTX, prototype bus which was built on GM funding alone and announced in 1968 and demonstrated both here in Detroit and in Washington, D. C.

GMC Truck and Coach Division

RTX FEATURES

Large windows	Low floor
Urethane bumpers	Single step
Oil cooled disc brakes	Turbine engine
Kneeling ability	Tandem rear axles
Power steering	"Swing axle" rear suspension
Air-leaf front suspension	Toric transmission
6 unit heating and air conditioning	Electro-luminescent interior lights
Sliding doors	Quartz halogen head lamps

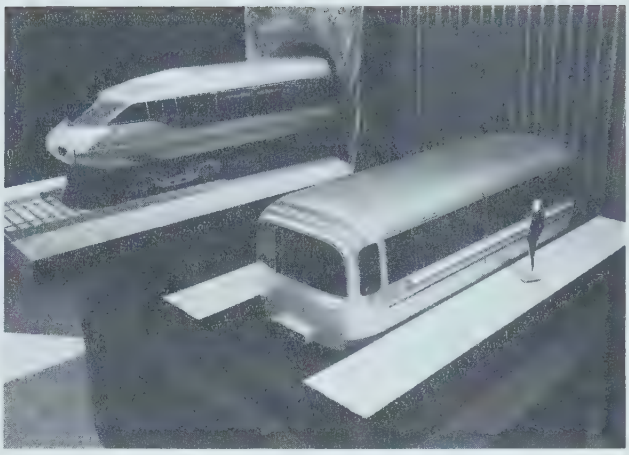
Rapid Transit Experimental (RTX) Bus

Innovations in bus design and demonstrated improvements in bus system operations are both General Motors contributions to better mass transit.

One additional step toward the future is exemplified by the GM Design Staff Personal Rapid Transit, or PRT, vehicle. It was first shown at TRANSPO '72 and serves as the basis for continuing transit design and market studies.

An additional step toward the future is exemplified by the GM Design Staff Modular Mobility or

Personal Rapid Transit (PRT) Vehicle



Dual-Powered Rail Transit Car

"building block" approach to the provision of a wide range of transportation components which share common parts. This concept has been applied to Personal Rapid Transit or PRT systems, and to the RTX transit coach. These ideas were first shown publicly at TRANSPO '72 and serve as the basis for further studies in all areas of public transportation.

Discussion Period

In response to a question as to the production and cost of the GM TRANSBUS, Mr. Spreitzer replied that the TRANSBUS vehicle design, prototype fabrication and evaluation program is a U.S. Department of Transportation (DOT) program that involves three contractors, one of which is the GMC Truck and Coach Division. The present schedule calls for GM to deliver three buses by 1974. He further added that costs and dates of production must await the evaluation phases of the program but it is likely that the TRANSBUS will include many features that will result in a higher cost.

In reply to a question concerning production and sales of the RTX transit vehicle, Mr. Spreitzer commented that the RTX is a prototype vehicle which serves as the basis for continuing studies and design programs at the GMC Truck and Coach Division. He noted that the financial requirements and problems of transit operators are such that new equipment purchases are increasingly dependent on Federal funds which in turn require competitive bidding and contract awards to the lowest bidder. He further added that the lack of specifications on innovative or new vehicles in the public requests for bids prevents consideration of designs such as the RTX, so there is no incentive or motivation for any manufacturer to proceed with such designs.

In response to an inquiry as to the present status of "People Mover" systems, Mr. Spreitzer stated that a small number of systems are in prototype operation and evaluation, including the DOT-sponsored program in Morgantown, West Virginia, and four DOT-sponsored tests which began at TRANSPO '72 and are now under continuing evaluations at Dulles Airport. In addition, he further noted that point-to-point people movers are in operation or construction at a number of airports, such as Houston, Tampa, Seattle-Tacoma and Dallas-Fort Worth.

Another questioner inquired about the Corpora-

tion's position on the use of the Highway Trust Fund for public transportation purposes. Mr. Spreitzer responded that the Corporation supports a balanced system of transportation and we have publicly supported financial assistance to urban transportation systems. We are always reviewing our position with respect to such matters. Relative cost and overall convenience to the public must be considered in resolving the transportation problems in and around American cities. He noted that the Federally-developed projected needs for highway investments far exceed the presently available funds, thus creating a real dilemma.

In response to a question on the "bunching problem" with transit buses, Mr. Spreitzer replied that General Motors presently has a demonstration program under way in cooperation with the Regional Transit Service in Rochester, New York. There is a reserved lane that has been equipped with a system so that passengers may be advised as to where to board their particular bus and the flow of buses is controlled to expedite service. Mr. Spreitzer added that it was too early to evaluate the results.

BASIC TRANSPORTATION VEHICLE

Richard L. Thornton
Manager, Basic Transportation Vehicle, GM Overseas Operations Division

A new transportation development by General Motors is the Basic Transportation Vehicle (BTV). Our approach was to create a vehicle which would have many uses to purchasers in the developing countries and at the same time be easy to build there.

The sheet metal for the Basic Transportation Vehicle is simple. There are no compound curves, which enables local builders to fabricate the body without expensive equipment. The same is true for the vehicle's frame.

Our local companies building and marketing this vehicle have developed a number of body styles which include not only this stake body on display here today, but also drop side pickup bodies and a small bus version. Currently, we are working on other versions to round out the line. In Manila our distributor is developing a body which looks something like the Jeepney, a very popular passenger transit vehicle or minibus in the Philippines.

We are currently building units in Malaysia, the Philippines, and have plans to make this vehicle available in many other countries in the future. We expect that it will be built not only in General Motors plants but also by local firms in areas where we do not have a plant. In these cases, the units will be manufactured and marketed by the local firm and have a local name. In Malaysia the name for the vehicle is "Harimau," the Malaysian word for "tiger," and in the Philippines the vehicle is called the "Harabas," which is the local word meaning "tough" or "rugged."

In order to minimize the investment by the local firm, GM will supply the power-train components from its plant in Great Britain. This unit has a 4-cylinder, 1300 cc engine which develops 59 horsepower. The other drive-train components are the transmission, propeller shaft, rear axle, and the front suspension with steering.

Our objectives for the Basic Transportation Vehicle are:

1) To provide transportation for people who do not have enough money to purchase conventional type vehicles.
2) To make the vehicle simple, yet adaptable to many personnel and goods carrying uses.
3) To have a large portion of each vehicle manufactured locally in order to reduce duties and tariffs as well as reduce foreign exchange requirements.

These objectives enable us to meet our design criteria, which were: low price, easy repair and service, and a number of components for local manufacture. As you can see, the BTV is a multipurpose personnel and goods carrier. It is not specifically a pickup truck, nor does it have 4-wheel drive.

Fundamentally we have tried to achieve a vehicle between the bicycle or motorcycle, and the commercial truck or automobile, which will permit an individual to travel more conveniently than he does with a tractor. We have tried to make this a very personal vehicle, as in many cases it will represent a customer's first major investment of any kind.

The major benefits to the customer and the country where the BTV is manufactured are:

1) Low-cost utility transportation.
2) Employment of local people in BTV manufacture.

3) Training and development of skills in the metal working trades and growth of the local supplier industry to furnish parts.
4) Foreign exchange savings through reduced import content per vehicle.

Although the BTV program is yet in the early stages, we are very pleased with the response that we received, particularly in the developing countries where the vehicle has been publicly displayed.

Discussion Period

In reply to a question concerning the price of the Basic Transportation Vehicle, Mr. Thornton stated that the retail list price of the cab and chassis in Malaysia, where reception to the vehicle has been very favorable, was $1,400.

In response to specific questions on the vehicle's components, Mr. Thornton noted that the mechanical components for the BTV come from the GM plant in Great Britain and that the liquid cooled engine is the powerplant used in the Bedford HA Van which has been sold in most countries outside the U.S. Top speed of the vehicle is approximately 65 mph, although safe driving speeds will vary greatly depending on the load carried by the vehicle and road conditions. Mr. Thornton stated that a four wheel hydraulic drum brake system is used; and at this time a four wheel drive is not available.

In response to a question concerning field experience and competition, Mr. Thornton replied that the BTV program is just getting under way and does not have a great deal of field experience. However, the unit has been endurance tested at the GM Proving Grounds and the Lang Lang Proving Ground in Australia with satisfactory results. The product competition varies from country to country. Mr. Thornton noted that the BTV will be competitively priced.

An individual inquired as to the durability and product life of the BTV. Mr. Thornton responded that the materials from which the unit is constructed (body and sheet metal) are of a heavy gauge. Prime coating to prevent rusting is a requirement for the assembly procedure. Also, provisions have been made so that the vehicle can be operated in heavy dust areas.

A number of individuals inquired whether the vehicle would be sold in the United States. Mr. Thornton indicated that it is not the Corporation's intention at the present time to market the BTV in the U.S. or Canada.

PRODUCT QUALITY AND CUSTOMER SERVICE

Richard L. Terrell

RICHARD L. TERRELL, *a Director and Executive Vice President in charge of the Car and Truck and Body and Assembly Divisions Group, is a member of GM's Executive and Administration Committees and five of GM's Policy Groups—Marketing, Engineering, Research, Industrial Relations and Public Relations, and Personnel Administration and Development.*

Mr. Terrell joined General Motors in 1937 as a member of GM Photographic in Detroit. In 1939 he was transferred to the Electro-Motive Division as a service engineer. During World War II, he served with the U.S. Navy in England as an advisor on American-built engines on the staff of Lord Mountbatten. After his discharge in 1945, Mr. Terrell rejoined Electro-Motive and after a series of sales and technical assignments was named Division Works Manager in 1953. He was appointed Administrative Assistant to the General Manager of Electro-Motive in 1958 and the following year became the Division's General Manager and was elected a Vice President of GM.

Mr. Terrell was named General Manager of Frigidaire Division in 1965 and was appointed Group Executive in charge of the Nonautomotive and Defense Group in 1968. He held that position until being named Group Vice President in 1970 with jurisdiction over the Car and Truck and Body and Assembly Divisions Group. He assumed his present position in October 1972 and was elected a Director of the Corporation.

Mr. Terrell is a member of a number of business and professional organizations and is active in civic affairs. He is a member of the Board of Trustees of the University of Dayton and Roanoke College and recently was nominated as a corporate member of the Boys' Clubs of Metropolitan Detroit and re-elected to the United Foundation Board of Directors. He also serves on the Board of General Mills, Inc.

My purpose today is to provide some perspective on the very important challenges of quality, recalls and dealer service. We can perhaps do this best in three steps; first, by defining the scope of the challenges and some analysis of how far we have come already; second, by examining the accelerating pace of change in manufacturing technology; and finally, by looking at what General Motors is doing to help the dealer do a better job of satisfying all of the customer's needs.

This of course is the major goal—a satisfied customer. Since the term recycling is a favorite of the day, let's put it this way. Our number one challenge is to recycle the customer—to bring him back to our products again and again. We want our customers to be more than satisfied. They should feel they are doing business with a dealer and a manufacturer who care about them as individuals and treat each one of them as though he or she were a special case.

The Quality Challenge

Now let's turn to the scope of the quality challenge. Many people cannot understand why every car sold is not in perfect condition. But those who do understand statistics feel just the opposite. They are amazed that we are able to push the laws of probability to such extremes.

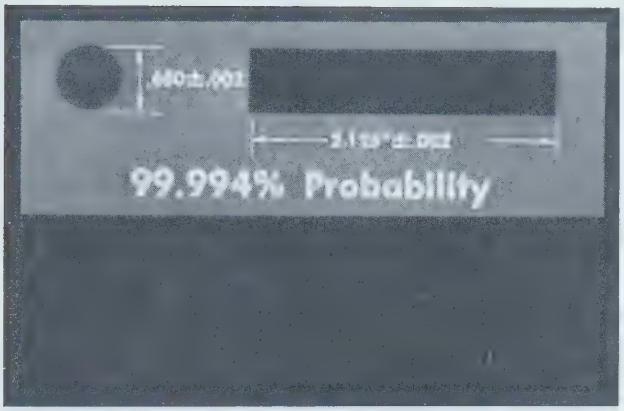
For example, the probability of a new car starting on demand is about 0.9995. That is higher than the reliability of some parts on Apollo missions. Such operating automotive reliability results from varying combinations of many parts and their individual dependability. Per hour of vehicle operation, the reliability of the starter motor is 0.99998, the generator at 0.999951, the voltage regulator at 0.999964, and so on.

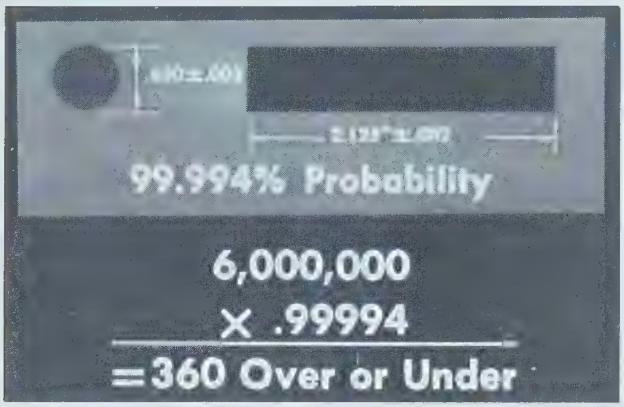
For comparison, the reliability per hour of the complex General Motors inertial guidance system for commercial aircraft is only 0.9988.

With reliability like this, you may ask, just what is the problem? And part of the answer is volume—sheer numbers. Look at a car model on the basis of maybe 1,500,000 copies distributed around the world. And they must operate in tropical heat, arctic cold, in dust, or slush, or slag, or mud, where the air is thin, or heavy or humid.

Even if design is flawless and manufacturing well within attainable tolerances, mass production still carries a built-in probability of a few defective parts over a production run.

Let's say that we are making a simple part to a specified length. The design is functionally good and no failure will occur if dimensions are held.





Assume manufacturing capability is excellent with a 99.994 percent probability of manufacturing the part correctly. Now, even with these unusually high conditions of conformance, of six million vehicles, 360 pieces would probably be outside our length dimension.

This, of course, is just the statistical or volume side. I do not mean to say that all quality problems and recalls are caused by statistics and thus are inevitable—far from it. The statistical side is presented to show that General Motors, because of its high volume, has the greatest challenge to produce parts that are literally identical and interchangeable. We intend to meet this challenge and find ways to repeal the laws of probability.

Now let's take a look at what is happening from the design board to the dealer service department. To reduce the chance for mistakes stemming from our high production volumes, we have initiated a concept we call Volume Risk Control (VRC).

VRC has two basic parts. First, we are developing and installing new machinery and equipment to increase our ability to maintain closer engineering specifications on parts, and second, and perhaps more important, we are increasing our surveillance efforts. This has a human side, which includes complete reorganization of our in-plant inspection departments to place separate responsibilities on reliability, quality control, and floor inspection—a system of checks and balances, if you will.

That old friend which institutional investors have come to know and to love—the auditor—has worked his way into the manufacturing process.

The divisions, of course, continuously audit the performance of manufacturing processes. This is done at each manufacturing and assembly plant, as well as at outside supplier facilities. In addition, we now have corporate-level audits, special teams visiting assembly and manufacturing plants periodically to evaluate local procedures, review plant records, and recommend changes in operations. The result sometimes is a fresh perspective—turning up problems that have escaped internal detection.

Improved Manufacturing Technology

The technology side of surveillance is even more promising. For example, Chevrolet Motor Division and the GM Manufacturing Development Staff developed an electronic wheel alignment monitoring system using the laser beam. It will inspect the front wheel geometry at production speeds. This could be a major breakthrough because wheel alignment has been a real source of problems in the field.

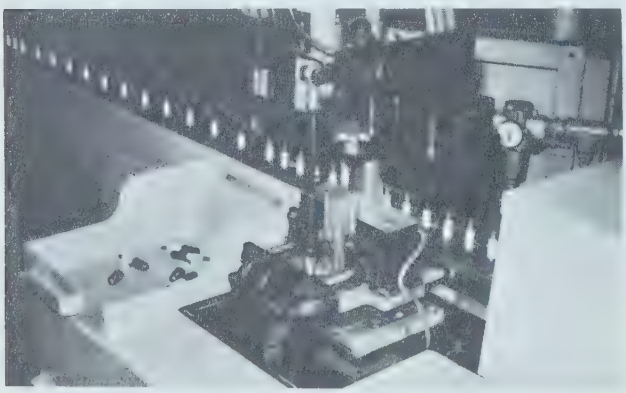
Laser Beam Wheel Alignment Monitoring System

Saginaw Steering Gear Division has pioneered some of the most advanced and unusual uses of testing technology. They use more nondestructive testing equipment, such as an electronic beam

microscope—a first in the industry—magnetic comparators, or eddy current devices, than any manufacturer in the country. The division also has the only high production x-ray equipment in the industry. All linkage tie rods are inspected for internal defects on this automatic scanner.

X-Ray Equipment for Nondestructive Testing

Another good example of improving reliability statistics is at AC Spark Plug Division. The installation of automatic spark plug gap checking equipment on the assembly lines, prior to the start of the 1972 model year, raised the defect-free rate from 99.5 percent to 99.8 percent. Then a quality assurance procedure using red penetrating dye to highlight insulator cracks during visual inspection raised the outgoing quality level to 99.96 percent defect-free.



Automatic Spark Plug Gap Checking Equipment

The potential for human error is also being reduced by improved long-term planning and by maintaining the engineering parameters of the vehicle over a longer period of time. We have intensified our forward planning efforts to better coordinate engineering and design with manufacturing capability and eliminate judgment errors of the design board. We know that newness is a factor in recalls and quality problems. Wherever possible, we hope to keep unnecessary changes to a minimum, and where changes are made, to use every modern tool of technology to identify and eliminate potential problems.

To accomplish these goals, we are using the computer in more sophisticated ways such as failure

Computer Application for Failure Mode Analysis and Buildability Simulation

mode analysis and buildability simulation. These techniques help us to analyze the hundreds of thousands of variables inherent in design, manufacturing and operation to tell us where we might go wrong.

Increased Vehicle Testing

Before the vehicles ever reach the production lines, we are doubling and tripling the number of prototype models as well as the lab testing of component parts. We are also doubling, tripling and even quadrupling the amount of road testing. For example, light-duty trucks received 700,000 miles of road testing in 1967. For the 1973 models, these trucks received two million miles. All of our pre-production cars and trucks are now getting 7,000 miles on the Belgian block schedule compared to 3,500 previously.

At any one time during the day at GM's Milford, Michigan, Proving Ground, an average of 300 cars are being test driven. These cars turn over a total of some 100,000 miles daily. And each year, the Proving Ground odometers roll up over 20 million miles.

We are also extending the durability tests under more severe conditions. These are the dirtiest, roughest, dustiest, coldest, hottest tests we can devise, with more of them in actual operating environments.

In addition, we have a fleet testing program which involves 6,000 vehicles in 35 locations in the U.S. and Canada. Currently, almost 20,000 individual parts are being tested.

One of these field laboratories, incidentally, is New York City, a tough proving ground for any experimental part. Because New York City taxis and fleet cars log so many miles so quickly, they are also an excellent early warning system for spotting imperfections in production vehicles.

With this extended testing in actual operating conditions, we are hoping to avoid the totally unexpected recall such as the one recently experienced with a steering coupling. It developed that if certain cars were driven over loose gravel on extremely rutted roads at speeds which cause the car to pitch excessively, the front frame crossmember may scoop up loose stones or gravel from the roadway. If the stones are a certain size, they may lodge between the steering coupling and the frame. At lower speeds, this could cause steering interference on a left turn. As you might guess, the odds of encountering all of these variables are very, very slim. The 3.7 million cars involved here have traveled approximately 54 billion miles to have 80 incidents. This is one per 675 million miles. Even though the GM corporate test program drove these cars almost 1.3 million miles, statistically, this would have produced only 1/525th of an incident. But General Motors, in what we consider to be a very responsible action, is taking no chances.

Obviously, we must be aware not only of how our cars are used but what's happening to the roads. For example, the use of salt on U.S. highways more than doubled from 1965 through 1970. We began an intensive corrosion-prevention program in an effort to avoid unexpected problems.

Yet try as we may, we cannot duplicate actual driving conditions in the field. Fifty thousand miles of durability driving in five weeks or five months at the Proving Ground is not the same as 50,000 miles of driving over five years in the hands of a customer. We cannot condense time. For this reason, we also need an effective early warning system for problems that do occur in the field.

All of the divisions now have improved systems of feedback from both dealers and customers. As an example, Chevrolet has selected a sample of 50 dealers across the country who are visited weekly by the Division's product and safety people.

Pontiac Division has a rather interesting experiment with a computer diagnostic link-up with dealers in Detroit. The dealers feed information on difficult service problems to a computer over the teletype. The computer tells them what tests to run, then analyzes the results. This system not only provides better service and helps to train employes, but also provides rapid feedback on problems.

As a sidelight here, it helps to have a computer programmer with a sense of humor. If you type in the wrong vehicle identification number to Pontiac, the computer gives a rather human response in the printout.

"Better recheck your V.I.N." writes the computer. "The one you gave me indicates that this car is an Oldsmobile, and since I am only programmed to identify Pontiac products, I'll have to pass. Sorry. If you find an error in the V.I.N. and want to try again, enter 'run'; if not, enter 'Bye'".

Providing Personal Service

This is a good place to turn to one of the most sensitive and critical areas in the automotive business—the challenge to provide outstanding personal service in our dealerships and to facilitate service no matter who does it.

I believe the truly effective marketer today must restore the kind of personal treatment that we often miss in today's business environment. General Motors is making an all-out effort to motivate dealers.

All the car divisions' zones in cooperation with the Marketing Staff Manpower Development Section are conducting meetings with dealership principals and with dealership employes. To the dealers we stress the need for greater involvement with their service operation. We call to their attention what the public is saying about dealer service, and ask them whether this applies to their dealership. Do they really know? And if it does, we offer specific suggestions for improvement.

In the employe meetings, emphasis is placed on

communications and tact in the day-to-day contact with customers—and the importance of doing the job right the first time. The program is known as "CODE 4 Satisfaction." CODE is an acronym for Customers, Owners, Dealers, and Employes. Since mid-June of last year, 6,160 dealers have attended 164 meetings in major markets, while in separate meetings more than 43,000 dealer employes have received our people-handling message.

Perhaps you remember the Chicago "Open Line" test which was conducted by GM in 1971. Owners could make complaints directly to Detroit headquarters. We learned from these toll-free calls that additional field service personnel were needed to assist dealers in preventing these complaints in the first place. We also discovered that women were better at receiving complaints, soothing irate owners and accurately recording details than the technically trained men.

An action plan was initiated in the 26 zones serving the New York, Washington, D.C., Chicago and Los Angeles markets. Young women were hired and trained to act as consumer advisors. The men were reassigned to field service positions. The number of service districts was increased from 97 to 174, so each service representative is now responsible for an average of only 10 dealerships instead of 18.

Another program that has been well received by dealers and field personnel is the annual evaluation of each dealer's service operation. Every dealership is rated for its performance in seven areas dealing with customer satisfaction. The results are discussed with the dealer and his service manager. Shortcomings are pointed out and assistance is offered for their correction.

Auto Mechanics Training

General Motors is also moving to improve both the status and the training of auto mechanics. Our 30 training centers, of course, continue to provide help to dealerships in training mechanics, sales and management people. In 1972, GM trainees received more than 4½ million hours of training.

Our training centers are also playing a key role in a Defense Department program, Project Transition, one of the most popular job-entry programs for returning servicemen. This training in auto mechanics is the type of program that benefits the nation, our young people and our industry.

Auto Mechanic Training

Mobile Training Van

To make our regular mechanic training more effective, all our car divisions are now using mobile training vans to reach outlying dealerships. The 67 vans now in use will be increased to 122 by the end of the year. As they spread out across the countryside, more of our customers will get better service from mechanics who are up-to-date on the latest product innovations and methods.

General Motors has also been a major contributor to development of the Mechanics Certification Program and formation of the National Institute for Automotive Service Excellence in Washington, D.C. Nearly 14,000 men took the first battery of four 3-hour tests in November 1972. We are convinced this is a better route to follow than attempting to license mechanics by state laws.

Facilitating Service Work

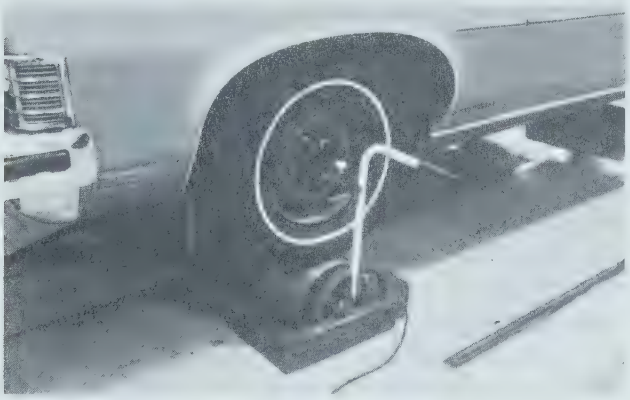
Another new direction taken by General Motors is the Service Research Section located at the Technical Center. In the past two years, Service

Research has been instrumental in developing new diagnostic equipment for the after-market. Outside firms are given the right to produce and distribute this equipment without charge from General Motors.

One interesting piece of equipment is called "The Shaker." This heavy-duty pneumatic vibrator is attached to the frame of the vehicle and then tuned to the frequency that brings out the rattle.

Pneumatic Vibrator ("The Shaker")

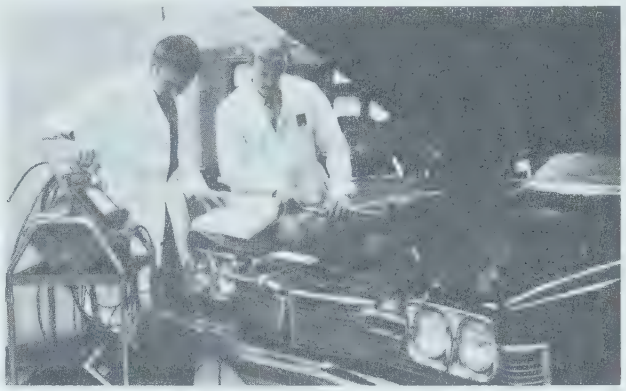
Another piece of equipment is the "Tire Problem Detector." It is designed to find such irregularities as out-of-round tires or variations in tread rigidity which behave like low or high spots. These can cause road vibrations that have been difficult and sometimes impossible to diagnose.



Tire Problem Detector

We have also been trying to facilitate service work by changing the product itself. A good example is the wear-indicating lower ball joint. Because lower ball joints are loose when correctly installed, this has resulted in a certain amount of unnecessary replacements. When a gauging surface designed into the ball joint is flush, replacement is indicated. Under normal service, replacement should not be necessary during the life of the car.

When it comes to serviceability, no one is harder on us than we ourselves. We have a serviceability exhibit every year at the Technical Center to point up areas that need improvement. Since Motors Insurance Corporation, our subsidiary which pays for the insurance repairs on many of our cars, takes part, you can bet that no punches are pulled.

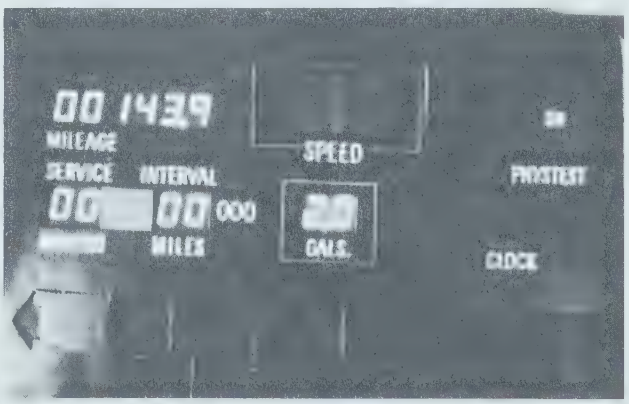


Serviceability Exhibit

Some of the results have been interesting. A good example is the modular instrument panel with increased accessibility from the front. Bulb replacement is now a simple matter.

Let's look to the future for just a moment to see what is coming up in this area of service.

It is now feasible to provide a computer to remind a driver that his car needs service. We have a variety of types of experimental vehicles with on-board computers. Some provide a very complete diagnostic center right on the instrument panel. These may someday maintain a constant check



On-Board Computerized Diagnostic Center

of dozens of items including brake wear and tire pressure.

People Are Important

As you can see, technology is changing the entire nature of the manufacturing and servicing challenge. But let me emphasize that technology is only one side of this equation. The greatest skill demanded by any organization is the other side—the people side.

We live in a world where both customers and employes feel a growing isolation from the forces that control their lives—isolation from those who manufacture and sell the products we depend on, isolation from those who employ us, and isolation from those who govern us. And yet, quality is a direct result of a sense of involvement and accomplishment. Pride is a belief in the product we make or buy and the people we work for. It comes from a feeling that people care about us and about the fruits of our labor.

I want to close by emphasizing that General Motors intends to be a place not only where technology reaches its full potential, but where every individual employe does as well. We are challenged to be as creative in our personnel methods as in our use of technology. We believe that General Motors has always been a good place to work, but today it must be something better. We need the involvement of every General Motors employe—we need the benefit of their creativity, their energy and their dedication. To gain this involvement, management must earn it. We must demonstrate a personal concern for our customers and our employes that cuts through their sense of isolation and makes them feel they are an important part of General Motors. And believe me, they are.

Discussion Period

A question was asked on procedures GM was initiating to enable its service personnel to deal with the new instruments and machinery required by the new emission-control equipment. Mr. Terrell replied that GM has a combined effort involving its Car Divisions, Service Research Center, and Manufacturing Development Staff personnel along with the design engineers in the development of such new systems. Mr. Terrell also noted that the Corporation is working on production test systems for use in its assembly plants and is attempting to provide tools and equipment for its dealers to check emissions in the field.

In response to a question on incentives for dealers to provide better customer service, Mr. Terrell stated that GM is emphasizing to its dealers that each dealership will be more successful if it provides good service for the customers as such satisfaction will cause these same customers to come back to buy their next new car. In addition, the service business can be made profitable and therefore, worthwhile for the dealer.

Asked about the subject of "do-it-yourself-maintenance" by consumers, Mr. Terrell said that GM has attempted to assist this technique and that such an approach has a place in the maintenance of cars. He cited various examples such as some features in the Chevrolet Vega where the owner can perform some of the service and said that the Vega manual was written with this concept in mind. Mr. Terrell stated that GM will continue its efforts in this area.

In reply to a question concerning use of a computer diagnostic approach by a foreign manufacturer on car care, Mr. Terrell responded that GM has been working for some time on the use of computers to diagnose service problems in automobiles. Mr. Terrell noted that the system has to be evaluated on a cost-benefit relationship.

EMPLOYE DEVELOPMENT AND THE MODERN WORK FORCE

Stephen H. Fuller

STEPHEN H. FULLER *joined General Motors in November 1971 as Vice President in charge of the newly created Personnel Administration and Development Staff. Mr. Fuller came to GM after a 24-year career at Harvard University.*

He received an A.B. degree from Ohio University in 1941, then entered Harvard Business School from which he received an I.A. degree in 1943, an M.B.A. in 1947, and a Doctor of Commercial Science degree in 1958. He was a member of the faculty of business administration at Harvard from 1947 to 1961, at which time he was named a full professor. From 1964 to 1969, he served as Associate Dean for External Affairs. He was on leave from Harvard while serving as President of the Asian Institute of Management from 1969 to 1971.

Mr. Fuller is active in a number of management development programs overseas, and has special interest in and knowledge of the Philippines. In 1971 he was presented the Presidential Medal of Merit of the Republic of the Philippines.

Mr. Fuller's present areas of responsibility include salaried personnel administration, organizational research and development, personnel communications, education and training programs, manpower recruitment, college relations, executive development, and General Motors Institute.

Dramatic forces of change are at work in our society today. There are signs of crisis in almost every major institution. Many of these center around people—the desire of individuals for a higher quality of life in their everyday lives and on the job.

Industrial concerns are being subjected to intense pressures seeking improvements in the work place and in the work environment. We hear and read a lot about "blue collar blues", "dehumanization of workers", "monotony on the assembly line" and "worker alienation".

Obviously, we in General Motors are concerned about the increasing criticism being directed toward the assembly line and other aspects of our business. Some false and very damaging impressions are being created in the public mind about the attitude of industrial management toward the new values and expectations of their employes.

It would be easy to console ourselves with the fact that the magnitude of our personnel problems has been blown way out of proportion. It would be easy to explain away part of our problems by asserting that the expressions of frustration and unrest in America's industrial plants and offices are but a reflection of conditions being experienced in society as a whole.

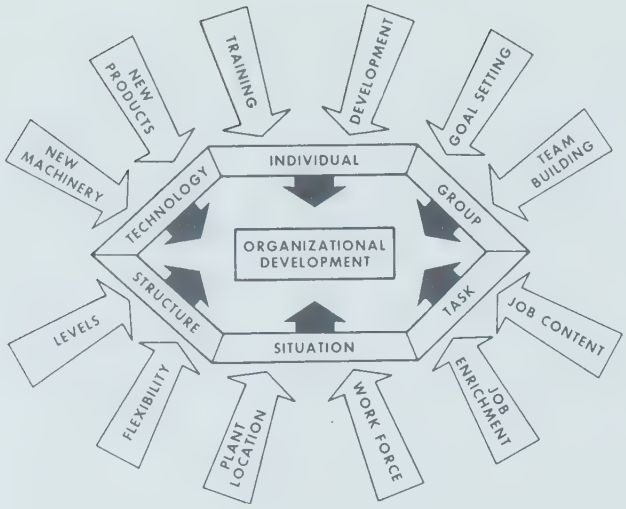
For us to neglect these concerns would constitute a failure to make a constructive response to them, and we would lose an unparalleled opportunity for additional innovations in the personnel function. We recognize that we do have people problems. And our concern is not limited to "blue collar" workers—it includes the needs and desires of all our employes. We cannot ignore the increasing public concern about the quality of life in the work place—any more than we can ignore the higher public expectations in such fields as safety, pollution, service and customer relations.

Quite a bit has been printed about such things as job rotation, job enrichment and employe motivation. Most of these programs are nice to talk and write about. But they usually fail to achieve significant or enduring improvements when applied as individual projects. In our opinion, there is no one plan, one program, or one solution which can be applied effectively in all situations.

Organizational Development

Our approach at General Motors—which is called "Organizational Development"—is based on scientific analysis and follow-up improvement action involving a wide variety of activities which encompass all major elements of the organization. Let me illustrate what I mean.

If we were to seek changes through the individual employe, two areas we might concentrate on would be training and other forms of personnel development. Improvement in the group process might involve goal setting or team building. If we want to effect a more efficient or more gratifying



Elements of Organizational Development Build-Up

execution of the task itself, changes in job content or various types of job enrichment might be attempted.

The situation at any given location at any given time will have a major influence on the types of action programs which would be most desirable. Situation factors might include the location of the plant, the makeup of the work force, the kind of supervision received, the organizational climate or the current stage of development from the standpoint of the human organization. Structural improvements might involve changes in the number of levels, relationships, flexibility and the communication process within the organization. We also must take into account the effects of technology —with new machinery, new products, new processes and the machine-man relationship being only a few examples. And finally, the overall organizational environment has a very important influence over all aspects of change.

The Overall Organizational Environment

Our approach is designed to evaluate the total organization and to map realistic corrective strategy which integrates all inter-related elements and takes into account their combined effects on organizational effectiveness. As a result, we are concerned not only with job enrichment and employe motivation, but also other activities such as increased employe involvement, better communications and training, team building and planned personnel development involving every employe.

Improvements also are sought through changes in such areas as job content, supervisory relationships, organizational structures and in the overall working environment. Highly important, we continue to learn as a corporation through a strong program of action-oriented research.

These are all basic elements of GM's philosophy of Organizational Development—a management concept which has gained wide acceptance throughout the Corporation and continues to grow. Its successful application depends on management's acceptance of change as a way of life, while putting people up front along with other basic elements of the organization.

The GM-ISR Project

One of the most significant projects in the field of Organizational Development involved a pilot study by General Motors utilizing the resources of the Institute for Social Research of the University of Michigan. Initiated in 1969, the GM-ISR Project marked the beginning of a long-range, scientifically-based program of Organizational Development within General Motors. Four General Motors plants were involved.

The GM-ISR Project had two major goals:

1) To seek long-term improvements in the human organization of General Motors.
2) To stimulate new concepts of managing people that are more consistent with the changing nature of the modern work force.

A survey was initially conducted among both hourly and salaried employes at the four GM plants to identify opportunities to improve plant performance. Using the information from the University of Michigan surveys which we conducted,

organizational development activities were then developed and implemented by GM management. Major emphasis was placed on increased involvement of all employes—along with improved training and information sharing—in an attempt to develop a more participative type of organization.

The Project—as a result of surveys conducted over the past four years—has shown that there is a clear relationship between plant performance and how employes feel about the organizational climate, quality of management and employe-management relationships.

Our experience has demonstrated that concentrated and continuing efforts to bring about improvements in these areas also can result in significant advances in employe morale and motivation, job satisfaction, labor relations and overall performance.

The Project has not only produced improvements at the plant locations involved but, even more importantly, it has served as a valuable test bed for experimenting with new and innovative approaches. From these activities have come improved management concepts concerning people—concepts which provide some of the fundamentals for GM's Organizational Development program.

Organizational Development Activities

There is no Corporation-wide package program. Rather, ours is a broad and highly flexible management philosophy which is applied differently in each organization and is undergoing constant change as we gain new knowledge and experience. Our Personnel Administration and Development Staff provides a variety of resources and services to assist operational units and to coordinate Corporation-wide efforts.

Organizational Development (OD) activities in GM have undergone extensive expansion during the past year or so. Formal OD functions are now operating in 11 major GM organizations and are in the process of being established in a number of other units. More than 80 organizational development specialists are working in 40 GM plants in the United States, Canada and several overseas subsidiaries.

To give you a better understanding of the magnitude and variety of our activities in this field, let me briefly cover some specific examples of people-oriented projects now going on in various General Motors operations.

A number of projects are designed to strengthen the foreman's job. One concept involves the assignment of an hourly employe to assist each production foreman in nonsupervisory functions. The foreman has more time to manage his work group and provide more personalized leadership to his people. This redefinition and strengthening of the foreman's job has been highly successful in improving work performance and relations between the foreman and his people.

Special attention is being devoted to control of absenteeism. In two major efforts, Buick and Oldsmobile Divisions went to their foremen and hourly employes for help in improving attendance—and the results were significant.

The Oldsmobile Division's Press Plant has a quality improvement program that emphasizes people involvement by encouraging the "people on the floor"—working with their foremen—to actually develop a plan of action for building higher quality hood and fender panels. The results have been significant improvements in quality, reduced repair costs and better employe attitudes.

The GMC Truck and Coach Division is experimenting with group assembly concepts in building motor homes in its Pontiac, Michigan, plant. This

Team Assembly

involves teams of employes doing a variety of jobs in completing major parts of the vehicle—such as body and chassis—contrasting with the typical auto assembly line where each employe specializes in only one operation. While the team approach appears to have potential only with very low-volume, specialized assembly work, experimental projects such as this may provide means for in-

creasing employe motivation and satisfaction.

The Individual Quality Program at Delco Electronics Division encourages both hourly and salaried employes to participate in establishing departmental and individual goals in a variety of areas. Major results have been reduced product repairs, decreased maintenance and improved attendance.

The use of measurement tools has increased substantially during the past year. The most highly regarded measurement instrument is the questionnaire survey which is being used to measure organizational effectiveness, to measure employe attitudes about their organization and the management environment, and to solicit ideas and suggestions from employes about means of improvement.

People-Oriented Activities

Some of GM's people-oriented activities are new and highly innovative in nature. Others have been in operation for a long time—with continuing changes to meet new requirements.

A good example is the GM Suggestion Plan which has been in operation for 30 years and has involved more than 200,000 employes in each of the past 10 years. This program has proved highly successful in generating useful ideas, increasing employe motivation, and improving two-way communications between employes and management.

Proper response by management to employe needs takes many forms. For example, the new GM-United Auto Workers Alcoholism Recovery Program—while not a part of our official Organizational Development activities—certainly attacks a serious health problem and one which affects employe performance.

In a way, our people problems appear to pose a dilemma. Cost and competitive pressures have never been more intense. Yet, achievement of a higher quality of life in our plants and offices is being interpreted by some as involving higher costs —thereby decreasing our competitive capability.

We do not view this as an either/or situation. Our challenge is not people versus profit; it is people and profit. We have to operate a successful business to maintain employment levels and to provide satisfactory wages and benefits. Conversely, our success depends on people—not just the few in management—but all of the people of General Motors, working together toward common goals.

Our people-oriented activities are designed to improve employe attitudes and behavior—and to increase job satisfaction. They also seek to increase the contributions which all employes can make to our success—through greater involvement and participation, through better training, information and other resources and tools.

When we involve our employes in this type of cooperative, understanding relationship, we all benefit. The employes win and so does GM.

If you want to know what people think about Organizational Development, you should talk to those who have been actively involved in programs of this type. We have done just that in a 30-minute film—entitled "Win-Win"—just released by our Staff. It features unrehearsed comments from people in eight different GM plants—expressing their ideas about their jobs, the work environment and what they feel are important elements of good employe-management relations.

Conclusion

In conclusion, let me say that General Motors recognizes and is attempting to respond to reasonable expectations and aspirations of its employes at every level. Management and employes alike are accepting the challenge of change in a constructive, cooperative manner which is strengthening the effectiveness of our entire organization while also improving the quality of work life for everyone involved.

For without our people, we can accomplish nothing. With them, anything.

Discussion Period

Responding to a question for recent data on turnover and absenteeism, Mr. Fuller stated that GM's national absenteeism levels have been declining and are, at the present time, about 4.9 percent of all scheduled work. In plants where specific organizational development activities have

been initiated, unscheduled absenteeism has shown a marked decline. He added that the turnover rate is slightly less than 8.5 percent.

Asked about the UAW's attitude toward the Organizational Development activity, Mr. Fuller responded by saying that the Union has demonstrated considerable interest. At the international level, the Union is advised of the experiments being conducted in various divisions. At the local level, the cooperation of the Union is obtained, and that quite often Committeemen of the Union participate.

In response to two questions concerning the application of "team approach" to the assembly of passenger cars, Mr. Fuller said that GM is experimenting in several plants, at such places as GMC Truck and Coach Division, on low volume items. The problems of the assembly line are actively being studied but the discontinuance of the assembly line as a production tool, in the near future, does not seem feasible. He further stated that GM is following the Volvo experiments of a team sub-assembly approach with great interest.

In reply to a question concerning GM's efforts in the employment of disadvantaged individuals, Mr. Fuller stated that GM, through the NAB Program, has employed approximately 68,000 such individuals and that the retention rate is quite favorable. He emphasized that GM is not only participating in the program, but is also participating very actively at the national level to provide leadership and considers its commitment to be a serious undertaking.

Mr. Fuller responded to a request for additional information about the status of the GM-UAW Alcoholism Recovery Program by stating that while the Program is relatively new, the results thus far have been most encouraging. The Program is voluntary on the part of the employe but such employes are receiving encouragement and support from others who have conquered their problem.

GENERAL MOTORS WORLDWIDE EMPLOYMENT EFFORTS

Thomas A. Murphy

THOMAS A. MURPHY *is a Director and Vice Chairman of the Board of General Motors and a member of the Finance, Executive, and Administration Committees. He has general responsibility for the Corporation's financial affairs and its overseas operations.*

Mr. Murphy was granted a B.S. degree in accounting from the University of Illinois in 1938. He then joined GM as a clerk on the Comptroller's Staff in Detroit. A short time later he was transferred to the Financial Staff in New York and held successive positions as an accountant, statistician, and supervisor of corporate forecasts and financial analysis. In 1954 he was placed in charge of analysis of corporation and divisional pricing and two years later was named Director, Financial Analysis Section in the Treasurer's Office. He then held successive positions as an Assistant Treasurer, Comptroller, and Treasurer of General Motors. In 1970 he was elected a Vice President and Group Executive in charge of the Car and Truck Group. He held this position when elected Vice Chairman in January 1972.

In addition to being a member of the three top policy-making Committees of General Motors, Mr. Murphy is a member of six of the Corporation's Policy Groups —Engineering, Industrial Relations and Public Relations, Marketing, Personnel Administration and Development, Research and Overseas.

Mr. Murphy is a member of the Financial Executives Institute, the University of Illinois Foundation's Board of Directors, and the Board of Trustees of the Financial Accounting Foundation. In 1972, Canisius College awarded Mr. Murphy an honorary degree of Doctor of Humane Letters.

Today, I would like to review some of General Motors worldwide employment efforts with you, including our progress in South Africa and in minority and female employment in the United States.

General Motors has a worldwide operating policy of offering equal employment opportunity to qualified applicants and employes regardless of an individual's race, color, religion, national origin, age or sex. This is our policy, and we make every effort to implement it in our 167 plants with 760,000 employes worldwide, working within the laws and customs of each of the 29 countries where we have operations. Implementation of this policy is evaluated throughout General Motors by Divisional and Staff executives as well as by top management. In each country, we want General Motors to be known as a law-abiding citizen which is concerned about the well-being and progress of all our employes and of all the people there.

Our attempts to create equal opportunity in the work place and the example we set for others has, we feel, proven to be a positive force for progressive change in the larger system.

In particular, we believe that General Motors presence, at home or abroad, is a strong influence for progressive employment conditions.

GM South African

South Africa is a country where our operation has expended considerable effort and realized sizable progress in improving conditions of employment. GM South African has an engine manufacturing plant located at Aloes, outside of Port Elizabeth.

GM South African Engine Manufacturing Plant, Aloes

An assembly and a manufacturing plant are located in Port Elizabeth about ten miles away.

GM South African employs over 4,800 people. In 1972, almost 41,000 passenger cars, commercial vehicles and trucks were produced and sold. Various components, such as engines, radiators, batteries, spark plugs, springs and many sheet

metal parts, are manufactured by this subsidiary. Dollar sales in 1972 totaled $154 million—of which less than 2 percent represented sale of vehicles and related parts to the government which could be classified as defense related. Additional sales are made to the government to meet normal transportation needs. Our profits in recent years have been nominal at best.

South Africa—Issues

The operations of U.S. companies in South Africa have been the subject of the increasing interest of certain segments of American society—most notably some church groups and political representatives. Needless to say, our continuing review of the South African matter has included discussions with these people.

The initial issue was that U.S. companies should withdraw from South Africa—thereby registering at least a visible protest and perhaps a decline in the economic vitality of the country. As public understanding of the South African situation has increased, there seems to be increasing agreement that U.S. companies should remain in that country and work toward progressive change—a position General Motors has always held.

The emphasis today is on disclosing information about operations in South Africa and the status of the Colored and African workers in that country as a means for accelerating economic equality in the work place.

GM Position on South Africa

Based on a thorough and continuing review of the South African situation, it has been and continues to be our view that we should remain in South Africa and work toward progressive change by doing everything reasonably possible to achieve economic and human equality in the work place. This is in our self-interest—to the degree we achieve success in these areas, we create opportunities for economic progress for our employes and create additional purchasing power in the country for our products.

Toward this objective, General Motors has expended a great deal of effort to upgrade its employment conditions in South Africa. And, substantial progress is being made.

Further, I believe GM management in the U.S. —and, based on my observations on a recent visit to GM South African, the local management there, in particular, as well—have a deep understanding of the situation and are vitally concerned with achieving continued progress.

We have made public a substantial amount of information on our South African operations. As Mr. Cole mentioned, a copy of Mr. Estes' presentation in October of last year has been distributed to all of the participants of this Conference (see enclosed supplement). This report was offered to all stockholders on request in our 1972 Third Quarter Report.

Updating Mr. Estes' presentation, let me now review briefly some of the problems involved and the steps taken by General Motors.

Legal Restrictions

The South African society includes restrictive measures toward certain areas of our business. For example, facilities must be provided for each race in such areas as cafeterias, drinking fountains and rest rooms for all employes and separate work facilities are required for salaried employes. Certain jobs are reserved for white employes, and the number of African employes is controlled.

As to promotions, there are three obstacles to full implementation of our policy of equal opportunity for advancement in South Africa. These are: (1) Colored and African employes are not permitted to supervise whites; (2) Africans are not permitted to engage in the collective bargaining process but do benefit from all the results of negotiations between the company and the Colored and white unions; and (3) as I have indicated, some jobs by law are reserved for whites.

Within these restrictions, however, there is sufficient latitude for concentration of the Corporation's efforts toward significant progress. GM South African intends to do everything in its power to provide maximum opportunities for all its South African employes.

Steps Taken by GM South African

As an example, 26 Colored and African employes are now supervising employes other than whites. This includes the first Colored foreman at GM South African.

An African Works Committee was elected in 1971 to represent African employes in meetings with management. Three African shop stewards

have also been appointed by the Works Committee to represent African employes in much the same manner and with the same responsibilities and privileges as the stewards appointed by the Colored and white trade unions.

The number of jobs reserved for whites has been reduced through agreements with the union over the past four years and continues to be a subject of negotiation.

Employment—Hourly and Salaried

Hourly and salaried employment at GM South African has changed very little over the past few months since Mr. Estes' presentation was published. Colored and African employes now total over 2,400—representing 70 percent of the hourly work force and 51 percent of our total employment.

	Hourly			Total	
	No.	%	Salaried	No.	%
White	1,067	30	1,333	2,400	49
Colored	1,829	52	19	1,848	38
African	619	18	2	621	13
Total Colored and African	2,448	70	21	2,469	51
Grand Total	3,515	100	1,354	4,869	100

GM South African Hourly And Salaried Employment

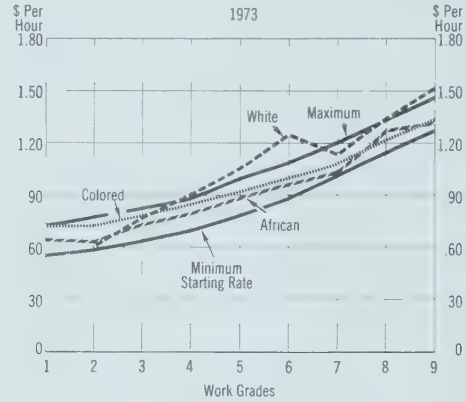
While custom in South Africa has generally restricted salaried positions for whites, GM South African has made some limited progress in this area. Colored and African salaried employes have recently been increased by six to a total of 21. This is far too few, but it is a beginning—reflecting GM South African's commitment for improvement.

Wage Rates

New minimum starting rates and maximum hourly wage rates have recently been established under a new wage program for Grades 1 through 9, in which almost all of GM South African's Colored and African employes are working. Positions in Grades 10 and 11 are currently held by white employes, except for one Colored employe in Grade 10.

Under this program, new employes receive the minimum starting wage rate shown for each grade. An automatic increase is granted after the first six months of employment. Each employe will, over a specified period of time, reach the maximum in his grade.

With regard to where we currently stand on hourly wage rates by race, the average rates for white employes in some grades are above the maximum established under the new wage structure. As a matter of fact, some employes of all race groups are receiving wage rates considerably higher than the maximums due to seniority and merit increases under GM South African's previous wage program. However, a concerted effort is being made to promote the employes who are being paid a rate higher than the maximum in their grade to higher grades as openings become available. Our training programs are of major importance in this endeavor. When our plan is fully effectuated, all employes will fall within the newly established ranges and the gap in average rates between the races will be substantially reduced.



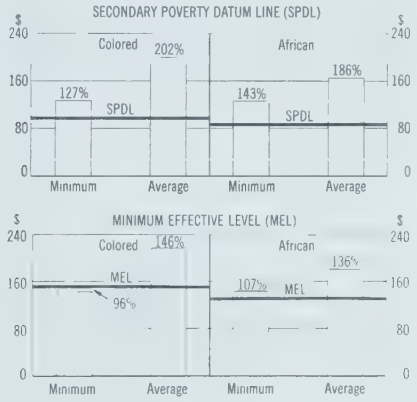
Hourly Wage Rates By Race—1973

These wage scales apply to the 3,500 GM South African hourly employes under a new union agreement, effective January 1, 1973. The operation's 1,350 salaried employes, including 21 Colored and Africans, are, on average, paid in excess of the average earnings of the hourly employes in the highest hourly work grade.

The salary structure at GM South African is comprised of 12 salary grades. The 21 Colored and African salaried employes are employed in Salary Grades 4 through 7 and are paid in accordance with our equal pay policy in South Africa.

To place wages paid by GM South African in

their proper economic perspective, it is helpful to look at a comparison of minimum and average earnings of our Colored and African employes in 1973 with the latest "Secondary Poverty Datum Line" for a Colored family of five and an African family of six in the Port Elizabeth area. The "Secondary Poverty Datum Line" was compiled by the University of Port Elizabeth for August 1972. This technique for describing the theoretical minimum cost of living is based on a calculation of the lowest possible costs to maintain a household in good health by Western standards.



Colored And African Monthly Earnings vs. Secondary Poverty Datum Line

The minimum and average earnings (based on a 45-hour week) for both races include a year-end gratuity, overtime payments and subsidies for food and transportation. The earnings of our employes are well above the "Secondary Poverty Datum Line."

Another measure of South African wages is known as the "Minimum Effective Level", which is 150 percent of the "Secondary Poverty Datum Line". This yardstick is believed by many to be more representative of a family's requirements because it allows expenditures for such items as medicine, amusement, savings, pocket money, etc.

When including the many benefits provided by GM South African, such as group life insurance, medical, sickness and accident, and retirement plans, minimum earnings of Colored employes are slightly below the "Minimum Effective Level", while average earnings of both races are well above this level. These earnings do not include the numerous educational benefits provided to many of our Colored and African employes, or vacation and holiday payments.

I might mention that the only employes that would fall below the effective level are Colored employes in Grade 1 with less than six months seniority. At the present time, there are only 35 Colored employes in this category. I should also point out that it has been suggested that the income difference between these two levels may be accounted for by the earnings of other members of the household. Estimates of the number of workers per household range from 1.4 to 1.8. However, the earnings mentioned are only for our employes.

Other Steps

Our wage as well as our benefit and training programs, outlined in detail in Mr. Estes' October presentation, give assurance of continuing economic progress for our employes. In addition, we are seeking to provide opportunities for proper housing and recreational facilities needed by our people in South Africa.

Last year, GM South African loaned the necessary funds to a number of Colored employes for a down payment to purchase their homes. We are investigating further programs of this nature. GM South African has held meetings with municipal authorities in Port Elizabeth to review various additional proposals for housing assistance. However, problems arise when attempting to provide a housing assistance plan for Africans because our African employes cannot own land under existing law.

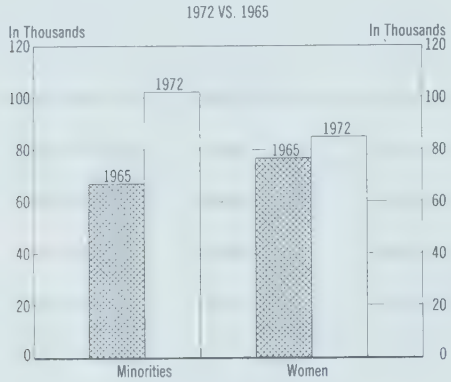
GM South African is also actively pursuing the possibility of providing recreational facilities for our employes. The construction by GM of rugby, cricket and soccer fields, a tennis court, a clubhouse and other related facilities in the Colored residential area was approved last year. Methods of providing recreational assistance for African employes are being finalized.

U.S. Minority and Female Employment

Now let's look at some highlights of our equal employment opportunity policy in operation here at home.

There has been an increase in General Motors employment of minorities and women in the U.S. between December 1965 and December 1972. The number of our minority employes has risen from

about 67,000 to 102,000. Over this period, minorities as a percentage of total GM employment in the United States increased from about 11 percent to almost 17 percent. It makes our employment

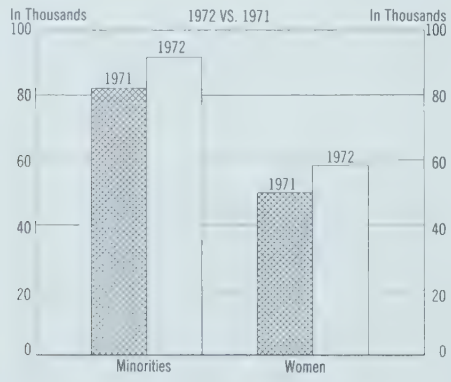


U.S. Minority And Female Employment—1972 vs. 1965

composition today closely resemble the U.S. population, where minorities also represent almost 17 percent of the total. It also brings our minority employment above the 100,000 mark for the first time.

While the increase in women employes was less impressive, it was still substantial—from approximately 77,000 to nearly 85,000.

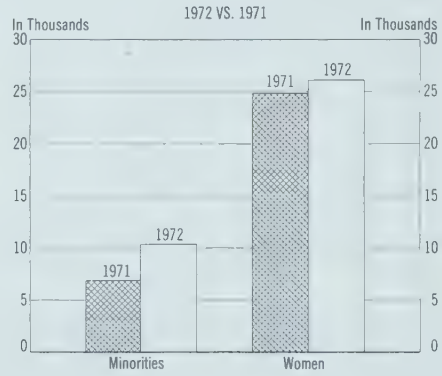
The number of minorities and women in GM blue collar jobs has increased over the past year. From December 1971 to December 1972, our minority blue collar employment showed an increase from about 82,000 to nearly 92,000—a gain of almost 10,000. Part of this increase can be attributed to General Motors active participation in the National Alliance of Businessmen program



U.S. Minority And Female Blue Collar Employment—1972 vs. 1971

for hiring and training disadvantaged persons, many of whom are from minority groups. We hired nearly 10,000 men and women under the NAB program during 1972 without government financial aid. At the same time, the number of women blue collar workers rose from about 50,000 at the end of 1971 to nearly 59,000 at the end of last year—an increase of almost 9,000.

Progress by minorities and women in white collar employment has also been achieved in General Motors during this same period. The number of minority white collar employes in General Motors rose from about 6,700 in December 1971 to more than 10,300 in December 1972. This increase represents a gain for minorities from less than 5 percent of our total white collar employment at the end of 1971 to more than 7 percent last December.

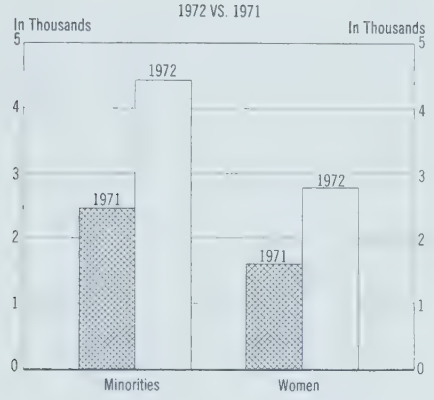


U.S. Minority And Female White Collar Employment—1972 vs. 1971

At the same time, the number of women in GM white collar positions increased from almost 25,000 to more than 26,000, bringing them close to 18 percent of our total white collar employment.

The movement of minorities and women into GM management levels as professionals, managers and technicians is accelerating sharply. Between December 1971 and December 1972, minorities in these positions increased from approximately 2,500 to over 4,400, a gain of 80 percent. At the same time, the number of women in these categories rose from 1,600 at the end of 1971 to almost 2,800 in December last year, an increase of more than 70 percent.

However, we are far from satisfied with the gains in white collar employment that minorities and women are making. We have a long way to go,



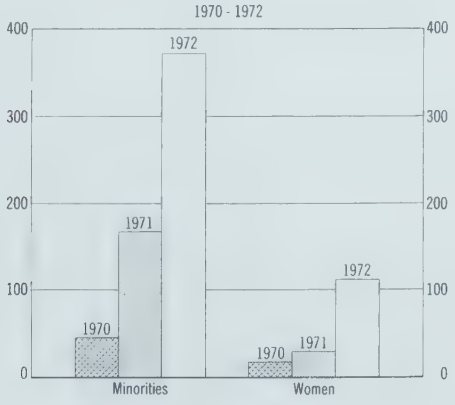
Minorities And Women In Professional, Managerial And Technical Positions In U.S.—1972 vs. 1971

and it will take time. But be assured that everyone in our organization is working hard to increase the job opportunities in this area as rapidly as possible.

Minorities and Women at GMI

We have a number of supporting activities to improve the hiring and upgrading of minorities and women, including programs at General Motors Institute in Flint, Michigan, which help to compensate for the small number of minorities and women who are technical college graduates in the United States.

The efforts of General Motors Institute and GM sponsoring units to increase the enrollment of minorities and women students at GMI over the past three years have produced positive results. Minority enrollment has risen from fewer than 50 students, or less than 2 percent of GMI's total enrollment in 1970, to 372, or more than 14 percent in 1972. During this same period, the number of women students at GMI has increased from 17,



Minorities And Women Enrolled At GMI

or less than 1 percent, to 112, or more than 4 percent. This progress is especially impressive when you consider that there have been only three women graduates from GMI since its founding in 1919.

Projections from GM sponsoring units for the class entering GMI next fall call for an additional 109 minority students and 150 new women students.

New GM Programs

There are several new GM programs to improve the participation of minorities and women in the salaried work force.

In 1971, a Pre-Engineering and Management Program was started at GMI for students who would otherwise not have been eligible for admission because they had not taken the required mathematics and physical science courses in high school. In many of these cases, the high schools attended did not offer the required courses.

Currently, 96 students are enrolled in the Pre-EM Program of whom 94 are minorities. Fourteen of the enrollees are women. They are admitted tuition-free for the first semester and are given individual help in mathematics, sciences, and communications.

This past fall a Liberal Arts Graduate Program, providing courses in basic management and production, was inaugurated at GMI with 73 students who have completed a liberal arts or other non-technical degree program at other colleges. These graduates include 54 minority men and 17 women, of whom eight are minorities.

College cooperative programs represent an outstanding recruitment source to bring minorities and women into white collar positions. These programs provide opportunities for minorities and women to get their college education while gaining practical work experience at General Motors. Because of the favorable results of this type of cooperative training, General Motors has increased the number of colleges with which it has established a college cooperative program. There are 81 colleges other than General Motors Institute, including 14 predominantly black colleges, involved with General Motors in cooperative training.

Minority Assistance Programs

At this point, let me briefly review General

Motors minority assistance programs. These include a variety of efforts aimed at improving the economic, social or health status of minorities.

In early 1970, we established Motor Enterprises, Inc., or "MEI", under the terms of the Small Business Investment Act to provide capital and managerial assistance to minority-owned small enterprises. Of the "MESBIC's" currently licensed under this Act, our MEI is the largest sponsored by a single company on the basis of paid-in capital.

General Motors has had a formal minority supplier program since late 1968. All GM divisions are now purchasing from minority suppliers. Further, all GM car lines now utilize parts manufactured by minority suppliers.

Automotive dealerships are a part of the economic mainstream which can offer significant opportunities to the minority entrepreneur. Since the beginning of 1970, the Corporation has increased the number of black-owned car and truck dealerships by 16 to a total of 21. Minority-owned GM dealerships now total 76.

The Corporation has been making deposits in minority banks for several years—with the objective of increasing the ability of these institutions to further the development and growth of minority business and job opportunities. General Motors program includes every known minority bank.

General Motors has reinsurance programs with the three largest black insurance companies, measured in terms of group insurance in force. Some of the Corporation's property damage insurance has also been placed through a black agency.

In addition to minority economic development, several other General Motors activities or programs offer assistance to minorities. These include training centers, support and encouragement to Opportunities Industrialization Centers of America, urban housing assistance, charitable and educational contributions to minority organizations, and participation by General Motors people in community activities related to minorities.

In summary, General Motors minority programs cover a wide range of activities and touch most areas of our business. These programs are helping to bring minorities into the main current of the American economy—not as quickly as we might wish, but steady progress is being made and will continue to be made.

Conclusion

We are working hard to implement our worldwide policy of equal employment opportunity. The job is far from easy, even here at home—but we will continue to try new ways to make entering General Motors more attractive to both minorities and women and advancement more accessible to those who are currently employed.

Today, we have tried to bring you up to date on some of the things we are doing to make this policy more effective and some of the results these efforts have produced. We have tried to illustrate the range of problems as well as accomplishments. And we have tried to deal factually with issues that are too easily and too often dealt with emotionally.

In spite of obvious difficulties, we are reporting important progress and look forward to continued improvement on a sound economic as well as social basis.

Discussion Period

With regard to Mr. Murphy's earlier statement that less than 2 percent of GM South African's total dollar sales in 1972 represented sale of vehicles and related parts to the government which could be classified as defense related, it was asked whether General Motors sells military equipment to the South African Army. Mr. Murphy replied that GM defense-related sales to the South African Government are comprised of trucks, commercial-type vehicles and related parts. He added, however, that these sales are the normal merchandise which GM sells in that country, in addition to passenger cars, locomotives and related parts.

In reply to a question concerning the actual maximum hourly wage rates by work grade classification and the percentage of the work force above the stated maximums, Mr. Murphy stated that the maximums under the current wage structure

at GM South African range from $.73 for Grade 1 up to $1.47 for Grade 9. Currently, there are several hundred people above the maximum in their grade, due to a carry-over of previous wage practices. He noted that GM is working as rapidly as possible to correct this situation.

The same individual requested a breakdown by race of compensation paid to salaried employes in Grades 4 through 7, in which all of GM South African's Colored and African salaried employes are working. Mr. Murphy stated that Colored and African salaried employes have pay scales that are in consonance with the white employes in the same salary grades. As a matter of policy, the Corporation has not disclosed any details on salaried employment and pay scales, either in the United States or in South Africa.

The same questioner indicated today's presentation had dealt quite extensively with the notion that GM should remain in South Africa in order to work for progressive change. Further, he requested any comment on the ability of GM to work for progressive change, not only among its own employes and through its wage policies, etc., but also through its recent contract with a platinum and palladium mining group in South Africa. It was noted that this contract provided an opportunity to work for progressive change in wages and working conditions for the miners in that country. Mr. Murphy responded that this action by the Corporation was to assure a source of supply for the platinum group metals which are essential for clean-up devices on motor vehicles to meet the pollution standards established by the U.S. Government. There are only two places in the world with substantial supplies of these platinum group metals—the Soviet Union and the Republic of South Africa. Discussions with the Soviet Union were unproductive. However, Mr. Murphy stated that GM was able to negotiate a development contract, which has now been superseded by a supply contract, with Impala Platinum Limited in the Republic of South Africa. Currently, Impala is bringing in people from other areas in South Africa and from surrounding countries to work in the mines. While the wages are not substantial, they are higher than in their home country. In addition, workers are provided with housing, food, clothing, medical treatment and transportation to and from their home country. Entertainment and recreational facilities are available, and the workers are also taught reading, writing and arithmetic as well as hygiene and first aid.

Mr. Murphy mentioned that GM has conducted discussions with the management of Impala and believes that they have an understanding of the Corporation's attitudes toward the employe environment and the treatment of employes. He stated that some members of GM management, including himself, had visited and inspected the mines. Mr. Murphy also noted that Impala was expanding existing mining operations in South Africa to accommodate GM's supply contract, and that the contract price is competitive.

An individual asked what a stockholder had to do to obtain a copy of Mr. Estes' October 16, 1972 presentation on General Motors and South Africa, and what the response had been. Mr. Murphy stated that stockholders merely had to write to the Corporation; in fact, only about 300 requests have been received. Mr. Murphy also indicated that Mr. Estes' presentation would be included as a supplement to the proceedings of this conference.

In response to a question on the possibility of having all supervisory positions over Africans held by African employes, Mr. Murphy replied that GM South African is placing qualified African employes in supervisory positions as these positions become available. Currently, 25 Colored and African hourly employes and one Colored foreman on the salaried payroll are supervising Colored and Africans at GM South African. There are an additional 18 Colored and 2 African salaried employes. Mr. Murphy further noted that supervision is mainly white, but GM South African is working as rapidly as possible to train Colored and African employes, which will allow them to assume jobs in the salaried category and hopefully in supervisory positions as well.

In questioning the stability of South Africa, an individual noted that a recent newspaper article in the U.S. mentioned a series of strikes by Africans and that the South African Government was concerned that these strikes might represent unrest in the country. Mr. Murphy stated that stability is a relative thing, and that based on his trip to South Africa he felt that the situation was very stable. Mr. Murphy also indicated that to his knowledge the Port Elizabeth area, where GM South African is located, has not experienced this

type of difficulty.

In response to the question of where General Motors practices in South Africa stand relative to domestic companies and other U.S. companies in South Africa, Mr. Murphy stated that General Motors believes it is at the top of the list and in the forefront of progress in that country.

Supplemental Information on General Motors Operations in South Africa

Description Of Typical Positions In Each Hourly Work Grade Classification

Work Grade	Typical Positions
1	Laborer; cleaner, body glass and tires; de-rust tank operator; gardener; material handler, unboxing.
2	Assembler "B": assembles or affixes components to vehicles, but does no adjusting; spot and seam welder; press operator; hooker/stacker; spark plug assembler.
3	Sander/flatter; machine operator—manufacturing; buffer and polisher; cushion cover assembler; convoy driver/vehicle loader.
4	Assembler "A": performs assembly operations which may include fitting and/or adjusting; material handler—general; production gas and/or arc welder; forklift truck driver; press operator—all around.
5	Spot and seam welder—senior: operates a variety of machines and supervises spot and seam welders in his zone; metal finisher; production sprayer; spring shop operator; heavy vehicle driver.
6	Assembler—all around: employe with ability to efficiently perform 2 or 3 Assembler "A" operations in any major section of an assembly or manufacturing plant; picker/checker; body dropper; door, decklid and bonnet adjuster; stores assistant.
7	Clerk general: performs diversified clerical work; patrolman; yard forklift truck driver; stockman: supplies urgently needed parts to production line; heavy vehicle driver—all around.
8	Checker; trim repairman; line inspector; paint repairman; metal finisher—all around: repairs or removes imperfections from sheet metal components using hand tools.
9	Group leader; mechanical repairman; uncertified artisan: employe who under supervision is employed on one or more aspects of work normally performed by an artisan; storeman; metal finisher inspector; receiving inspector.
10	Toolmaker; maintenance fitter; electrician; final inspector; fitter and turner.
11	Garage technician: diagnoses by means of electronic testing equipment and repairs motor vehicles; assistant artisan foreman; layout and garage inspector; evaluation technician: dismantles engines after test runs and examines component parts; vehicle appraiser: appraises quality level of current fleet vehicles to identify material quality and assembly problems.

Minimum, After Six Months, And Maximum Wage Rates And Average Hourly Wage Rates By Work Grade Classification And Race

1973

Work Grade	Current Wage Structure			Average		
	Minimum	After 6 Months	Maximum	White	Colored	African
	$	$	$	$	$	$
1	.56	.60	.73	—	.73	.65
2	.59	.63	.78	.61	.73	.64
3	.64	.68	.83	.78	.79	.74
4	.70	.74	.89	.91	.86	.80
5	.79	.83	1.00	1.07	.93	.89
6	.89	.95	1.09	1.26	1.01	.97
7	1.02	1.07	1.21	1.15	1.09	1.04
8	1.15	1.21	1.34	1.35	1.23	1.28
9	1.28	1.34	1.47	1.53	1.35	1.33
10	1.47	1.55	*	1.93	1.65	—
11	1.66	1.75	*	2.21	—	—

*Subject to availability of labor.

NOTE: Conversion rate used is 1 Rand=$1.2773, which is the rate established by the International Monetary Fund, effective October 24, 1972.

CLOSING REMARKS—AN OVERVIEW OF BUSINESS TODAY

Richard C. Gerstenberg

RICHARD C. GERSTENBERG *joined General Motors in 1932 as a timekeeper with the Frigidaire Division, shortly after graduating from the University of Michigan with a Bachelor of Arts degree. He was transferred to the Fisher Body Division, Detroit, in 1934 and two years later joined GM's Financial Staff. In 1949, he was named Assistant Comptroller and, in 1956, became Treasurer of General Motors.*

Mr. Gerstenberg was elected Vice President in charge of the Financial Staff in 1960. He was elected Executive Vice President—Finance and a member of the Board of Directors in 1967. Three years later he was elected Vice Chairman of the Board and Chairman of the Corporation's Finance Committee. His election as Chairman and Chief Executive Officer of GM was effective January 1, 1972. He also is a member of the Executive and Administration Committees.

Active in the educational field, Mr. Gerstenberg is a member of the Visiting Committee for the University of Michigan Graduate School of Business Administration. He also is a Director of the United Negro College Fund, Inc. and serves as Chairman of the Fund's National Corporations Committee. In addition, he is Chairman of the National Alliance of Businessmen, a member of the Business Council, and serves on the Board and as Vice Chairman of New Detroit, Inc. He has been awarded an honorary Doctor of Law Degree from Marquette University and an honorary Doctor of Commercial Science degree from the University of Toledo.

It has been for me, and I hope for all of you, an extremely interesting day. As you know, this is the third of these annual Conferences. They have come to occupy a very important place on our General Motors calendar of events. We in management look forward to them as an excellent opportunity not only for us to give an accounting of what we are doing, but to gain a better feel of what more we ought to be doing.

We look to you, by your comments and your questions and your reactions, to give us guidance in how General Motors might continue to operate a successful business and at the same time better fulfill all the expectations of the society we are so eager to serve. We want very much not only to be doing the right thing now, but we want to prepare ourselves now so we can fulfill society's expectations for all the years ahead.

In the automobile business, our eye must always be on the future. We must make decisions right now about products that won't be on the market for several years. I suppose it can be said that a good part of whatever success General Motors has achieved over the years can be traced to our ability to anticipate, soon enough, the taste and needs of the motoring public.

A newer and more complex imperative of our times, however, is the question of how a corporation stays in touch with and anticipates social change. The most successful business in the years ahead will be the one that not only offers quality products at competitive prices, but also succeeds in matching its resources to society's changing demands, the business that is best able to give creative response to the social aspirations of the people it serves. Conversely, the business that fails in the years ahead will be the one that fails to understand how it is related to the society around it and will, therefore, overlook opportunities for service, for growth, and for profit.

GM's Public Policy Committee

These annual Conferences are one means by which we at General Motors try to better assure our continuing ability to stay in touch with change and to respond to our society's changing needs. This was the same motivation we felt in 1970 when we established a Public Policy Committee as a permanent standing committee of the Board of Directors. This was the first group of this kind in a major industrial corporation. Our Public Policy Committee is now in its third year. Because I think you might find its origins and activities interesting and informative, I would like to tell you something about this Committee today.

Its five members are all Directors of GM, but none is an officer of the Corporation. The Committee is chaired by John A. Mayer, Chairman of the Board of Mellon National Bank & Trust. The other members are John T. Connor, Chairman of

Allied Chemical and a former Secretary of Commerce under the late President Johnson; James R. Killian, Jr., who is Honorary Chairman of the Massachusetts Institute of Technology and a former science adviser to President Eisenhower; George Russell, a retired Vice Chairman of General Motors; and Gerald A. Sivage who is President of Marshall Field in Chicago. Thus, you see, it brings together five broad-gauged men who are experienced in business and finance as well as in science and government.

The purpose of the Public Policy Committee is to give matters of broad national concern a permanent and prominent place at the highest level of management—and I would emphasize this "at the highest level of management,"—right there on the Board of Directors, which ought to be quick to perceive change and quick to grasp the opportunity of responding to it.

The Committee's mandate is to inquire into every phase of the Corporation's business activities that relates to matters of public policy, and to recommend any changes it feels appropriate to management or the full Board of Directors. The existence of this Public Policy Committee assures us that broad national concerns are considered in the major policy decisions of the Corporation. This includes, of course, all the subjects we have touched upon in the presentations today, and many more.

The Committee meets regularly once or twice every month. Its inquiries, deliberations and development of recommendations are conducted in executive sessions because the members feel this better ensures the confidentiality of financial and technical data. It also promotes frank and responsive discussion among the members and with the individuals they frequently invite to present outside viewpoints.

In addition to requesting and receiving reports and presentations from management, the Committee also pursues inquiries independent of the Corporation. This includes consultation with outside experts, many of whom, I might note, have views contrary to those of the Corporation. The Committee has been kind enough to also invite me, or my predecessor as Chairman, James M. Roche, to be present for a portion of most of the Committee meetings.

While the Committee has made recommendations to General Motors management and the Board of Directors, the Committee has found that it functions most effectively by exploring subjects with management and by the interplay of discussion. Action is then implemented either directly by management or, as appropriate, by the Board.

Several significant steps taken by General Motors in the area of public concern can be directly attributed to the Public Policy Committee. One example is the establishment of the General Motors Science Advisory Committee to advise us on our research and development programs and other technological areas of the company's business. The Science Advisory Committee, in turn, recommended a major expansion of the General Motors Research Laboratories to augment the Corporation's research capabilities. We announced this expansion at this Conference last year, and Paul Chenea brought you up to date on its progress this morning. This, as we said last year, is one part of our continuing effort to make General Motors better prepared for tomorrow. We are also making strong efforts in the other areas we have discussed here—and I am confident we will continue.

Response to Social Change

But today, as a businessman and as a citizen, I must admit to a number of concerns. We have heard a great deal in recent years about corporate responsibility and the need for business to work actively for the well-being of the entire society. We at General Motors feel we have always acted upon our responsibilities to society to the full extent of our understanding and our ability. In recent years, however, the public has come to expect business to take on responsibilities quite beyond the traditional concerns of earlier and simpler times.

General Motors, largely because of its size and the prominence of its products in American life, is the frequent target for criticism. In fact, just last week, I read in the newspaper that a spokesman for the Project on Corporate Responsibility said the group had decided to continue to concentrate on GM and abandon others in our industry. They said, "General Motors is a symbol of all corporations, and certainly a symbol of the automobile industry."

We at General Motors are accustomed to this attention, and we accept it. We have come to

understand it as part of the penalty of leadership. We regard the response to social change as another test of our capacity as a corporation to meet the needs of our society and we welcome it as such.

By no means can it be said, for General Motors or for any other major corporation, that the response is complete and the job accomplished. The work of our free society, the work of our America, is never done. Nor should it ever be. Yet, speaking for my colleagues and myself at General Motors, I feel a great deal of encouragement. In the past few years we have taken extraordinary steps, some of which we have detailed here today, to allow us to deal with the enlarged public expectations of General Motors' role in society.

We, of course, are not alone in this. Beginning in the late 1960's, business generally has demonstrated a wholesome concern for the well-being of our society, as well as the more familiar and fundamental interests of the stockholders who own the business, of the employes who depend upon it for a livelihood, and the customers who expect and deserve full value in the products they buy.

A Businessman's Concerns

Today, having mentioned my long-standing businessman's concern for the stockholder, the employe, and the customer—I would like to speak as well of the other concerns that I feel.

Here are a few of these concerns:

I am concerned about a society that cries for the production of more energy, and yet whose individuals are so reluctant to take the steps that are available to increase the supply of energy. As Erni Starkman has said, General Motors is at work on the problems presented by the much-discussed national energy crisis. General Motors has developed, and is testing in our Cleveland, Ohio, Chevrolet plant, a system which we think will enable us to burn coal—our most abundant energy resource—with fewer of the polluting effects previously encountered in the use of coal. This system holds promise of important benefits, not only to General Motors but to all industry in the energy-hungry years that appear to be ahead.

Our cars and trucks, of course, are significant users of the nation's fuel supplies. Our long-range product planning must consider the potential of future shortages of available energy. Fuel conservation is becoming an even more important design criterion as we plan the automobiles and trucks that we will build and sell in the late Seventies. Lead time, however, is a most difficult taskmaster in our industry. We have to consider more immediate steps that we as a Corporation might take long before the products we plan today will be in the hands of consumers.

In the days and months immediately ahead, such fundamental practices as the means of transportation from home to work, the means to economize on our society's uses of energy, and our attitude as individuals, as a Corporation, and as a nation to the funding of public transportation systems must receive our most careful consideration. The cost and convenience to the public must remain in the forefront of our thinking as we seek remedies for the transportation problems in and around our American cities. If we care about the future of our cities, we must provide better transportation in and out of the cities. Unless we do, the traffic will move only one way—and that way is out.

I am also concerned with a society that deplores traffic deaths but is unwilling to buckle up a seat belt; that lacks the political courage to enforce its traffic laws and take action against the drinking driver.

I am concerned when many prominent Americans, including some leaders of American labor support antiquated protectionist legislation, like the Burke-Hartke Bill, even as some segments of organized labor defeat productivity by a reluctance to encourage a fair day's work for a fair day's pay at a time when we need an all-out effort to improve productivity so that our nation might better compete with other nations.

I am concerned about a society that has demonstrably lost confidence in its institutions—in government, in the press, in the church, in the military—as well as in business.

I am concerned when people no longer believe what they read in the papers—but politicians do; when government at all levels so often mis-reads the public mind, when hasty over-regulation so often wastes precious national resources.

I am most immediately concerned, as a businessman and as a citizen, by the growth of unreasonable regulation, because I believe that much of our American future depends upon our nation's ability

to keep free enterprise free, and to permit it to grow in freedom.

However tempting it may seem, business problems should not be sent to Washington for decision. Government, as opposed to business, lacks the multiple and diverse centers of initiative, the direct proximity to problems, and the motivations for success that distinguish competitive enterprise. Yet, even as I say this, I recognize that there is everywhere a growing involvement of government in business, and a consequent diminishing of our traditional freedom.

No businessman today, neither the head of a large company nor the corner grocer, can operate without consideration of government restrictions and regulations. His costs and his profits can be affected as much by a bill passed in a distant capital as by a management decision in the front office or a customer's decision at his checkout counter.

The Increasing Burden of Regulation

I speak from my own experience in the automobile business. We are all too aware that we operate under an increasing burden of regulation. The design and manufacture of the 1973 automobile, for example, is subject to 44 government standards and regulations involving about 780 separate test points which must be met on each car. Government today has something to say about how we design our products, how we build them, how we test them, how we advertise them, how we sell them, how we warrant them, how we repair them, the compensation we pay our employes, and even the prices we may charge our customers.

It is surely understandable that businessmen like myself should sometimes long for a return to simpler days, to the uncomplicated world of buy and sell we used to know. We must not, however, waste ourselves in yearning for a time that is gone. The involvement of government in business today is a fact of life. Even as we deplore many aspects of it, we must admit that some of this involvement is necessary, and some of it is good.

General Motors is not blind to this; instead we acknowledge it. We do so in order that we can cooperate more effectively with government and thereby better serve the public.

In less complicated times, business and government dealt with each other very much at arm's length. In many respects, these two institutions have come together as virtual strangers, and not without reason. American business has grown and flourished in a tradition of non-interference, in a climate of hands-off, in an attitude of the least government being the best government.

In the more specialized world of today, people select their fields early in life and pursue increasingly narrow, more specialized careers. The way of business and the way of government differ in their methods of operation and in their standards of success. Inevitably those in one field tend to grow more apart from, more separate from, more out of touch with those in the other.

A Time for Working Together

Our times can no longer tolerate such separateness. Now, we must work purposefully with government so that we can together make our industry better able to satisfy the needs of our people. More and more, business and government are working together to shape our national policy and to fulfill our public purpose. And there is much, much more for us to do.

The challenges to our nation in the future will be no less. We can expect, then—and perhaps even encourage—business and government to draw even closer together—not to constrain by regulation, but to cooperate for greater freedom. All in business—and indeed all in America—stand to gain if free enterprise and representative government, these two great cornerstones of our democracy, can work together.

To serve the goals we share, business and government have an obligation to communicate and exchange views. We must encourage an atmosphere of mutual trust and confidence, with each respecting the rights and opinions of the other. We should not expect that we will always agree, but we can hope to achieve a closer understanding.

Government, on the one hand, must demonstrate a more informed understanding of what the public really wants and the role of business in meeting these wants. Government must weigh more carefully the consequences and the costs of regulation in terms of its benefits to society. Business, for its part, must try to take a broader view, to widen its traditional role, to be at all times alert to the expectations of the society. Each

company must look outside itself—and outside its own industry—to see itself in a wider perspective, as an element in the entire economy and as an influence in the community, be it local or even national.

The inevitable consequence of centuries of separateness is misunderstanding. And business as a whole is surely not well enough understood—not by government and not by the people.

The Businessman—Contributor to Society

For too long, the businessman has been maligned and misinterpreted and mistaken for an exploiter of society instead of a contributor to society. By the indifference or inaction of business, the once-proud calling of business has fallen into a kind of disrepute which does a grave disservice not only to all businessmen, but to our economy and to the reputation that our nation has enjoyed in the world.

Business, in the parlance of public relations, has suffered a serious loss of image. Consider, if you will, how the new attitudes of the '70's have rewritten the cliches of less than a generation ago. What was once an "honest profit" is now the "unconscionable profit." The "business world" is now part of the sinister "establishment." The "arsenal of democracy" which won World War II has become the "military-industrial complex." And the word "industry", which once stood for progress, now stands for "pollution."

There was a time when to be a man of business was a proud calling. Now, to more and more people, the once familiar world of business is an alien—even a hostile—environment, and the choice of a career in business is regarded as some kind of a cop-out. This is further damaging to our efforts to compete abroad because other countries still hold business in high respect and give it close cooperation.

These erroneous attitudes in the United States are distorting the shape of our society. Because they are so prevalent in the public mind, they are affecting the decisions, the beliefs, and the actions of the men and women who govern us.

The choices before the American people today are hard choices. It is surely not easy to choose between economics and ecology, productivity and protectionism, personal involvement and professional detachment. These hard choices are being made every day—but not always wisely. Yet, it is essential to our American future that the people be so well informed and so well motivated that their choices will be the right choices.

Confidence in the Future

This is part of what brings us together today. Our subject is "Progress in Areas of Public Concern." The single greatest concern we share is the well-being of our nation and all of its people.

But let me assure you that the concern that my colleagues and I feel is in no way at the expense of the confidence—the great and growing confidence—we feel about the future.

We are confident, first, because business is good—very good indeed. The American automobile industry has posted two consecutive record years, and we have begun on a third. We are meeting strong competition from foreign manufacturers. This business has always grown because of competition, and we welcome it. And as I say, we are meeting it. The new American small cars, such as the Vega, have checked the inroads the imports were making into the American market, and all the gains we made last year and expect to make this year have been gains for the American-built cars.

A second reason for confidence is what I hope you will agree is an excellent demonstration of progress in responding to society's expectations in these areas of public concern. We have not solved these problems, to be sure. But we do feel that we have developed a better awareness of them and have organized ourselves so that we can deal with them more effectively.

A third and larger reason for confidence is my conviction that the great characteristics that have lifted our nation to its eminence in the world are not going to be lost in the years ahead. We still have many jobs to do to enhance the quality of life here at home and all around the world. But America also has the resources to do these jobs.

With your help, your understanding and your support, we at General Motors will continue to do our utmost to assure that these great national resources are used wisely and well.

"GENERAL MOTORS AND SOUTH AFRICA"

A Presentation
by
E. M. Estes
Executive Vice President
General Motors Corporation

Before a
Seminar Sponsored by the
Council on Religion and
International Affairs

Airlie, Virginia
October 16, 1972

ELLIOTT M. ESTES *is Executive Vice President in charge of the Operations Staff and a member of the Board of Directors. He was elected to these positions in 1972, after serving as Group Executive with jurisdiction over the Corporation's Overseas Operations.*

Mr. Estes joined GM in 1934 as a cooperative student at General Motors Institute sponsored by the Research Laboratories. He attended GMI for four years, then studied at the University of Cincinnati, which granted him a degree in mechanical engineering in 1940. He returned to the Research Laboratories and, in 1945, was made a senior engineer. The following year, he was transferred to Oldsmobile Division as a motor development engineer. Following a series of executive engineering assignments at Oldsmobile, he became Assistant Chief Engineer in 1954. Two years later he was appointed Chief Engineer of Pontiac Motor Division and was named Vice President and General Manager of Pontiac in 1961. Four years later, Mr. Estes became General Manager of Chevrolet Motor Division and in 1969 was appointed Group Executive in charge of the Car and Truck Group. The following year he was appointed Group Vice President in charge of Overseas Operations.

Mr. Estes is a member of the Corporation's Executive and Administration Committees and six of GM's policy groups—Overseas, Marketing, Personnel Administration and Development, Industrial Relations and Public Relations, Engineering, and Research.

I would like to review General Motors efforts in South Africa with you.

The subject of South Africa and the efforts of U.S. companies there have over the past couple of years received great attention. This attention has focused on the impact of the U.S. presence on progress for the African and Colored population in that country, as well as on disclosure of information on this progress. Stockholder proposals have been submitted to numerous companies, including General Motors. The overwhelming stockholder response has provided management with a clear mandate to remain in South Africa and continue trying our best to make a positive contribution to progressive change.

General Motors has operated in South Africa for 46 years. Because we feel it to be in the best interests of our stockholders and our South African employes, we will continue to operate in South Africa.

General Motors has published a substantial amount of information on its operations in South Africa—so that our stockholders, as well as the public, can make an informed judgment on this important matter. This presentation is a manifestation of our commitment.

Developments in 1972

The year 1972 has brought some important developments. R. C. Gerstenberg, Chairman of General Motors, visited our South African operations in April of this year. He returned firmly convinced that General Motors should remain in South Africa and continue its role as a leader in upgrading the economic and social status of its employes. The evidence was overwhelming and reflected the virtually unanimous judgment of the many people with whom he spoke. These included representative factory employes of GM South African, numerous business and community leaders, both black and white, as well as various Government officials.

Additional disclosure of information on their South African activities has been made by several U.S. companies. As a result, I have observed a broadening realization of the advantages of U.S. companies remaining in South Africa as an important force toward progressive change.

In South Africa, protests by many individuals and groups, including blacks, churches and students, as well as liberal-minded whites, continue to be made against apartheid. Further, both African leaders and church spokesmen have become more vocal and are achieving increased

visibility and identity. One leader recently called for a single black nation in South Africa and a land allocation more in proportion to population. He also reportedly stated that he would not accept anything that is short of equality. He was able to state this in South Africa, and it was publicized in the South African press.

In addition, the first black American diplomat has been assigned to the United States Embassy in South Africa. He will take the position of Economic and Commercial Officer in late 1972.

I believe these developments are all contributing to the psychology of change in South Africa. At the same time, more Americans have become aware of the issues involved. Overall, the year 1972 has been one of advancement—and for General Motors, one of steady progress in our efforts in that country.

General Motors South African

To put GM's efforts in South Africa in perspective, let me briefly describe our operating subsidiary—GM South African. GMSA's engine manufacturing plant is located at Aloes, outside of Port Elizabeth. In addition, an assembly plant and a manufacturing plant are located about ten miles away. GM South African employs approximately 4,800 people. Over 36,000 passenger cars, commercial vehicles and trucks were produced and sold in 1971. The subsidiary manufactures components such as engines, radiators, batteries, spark plugs, springs and many sheet metal parts. Dollar sales totaled $140 million in 1971. Also, General Motors Acceptance Corporation conducts financing operations in South Africa through its subsidiary, GMAC South Africa (Pty.) Ltd.

General Motors impact can be viewed in two dimensions—one, in its employment practices aimed at upgrading the economic status of its Colored and African employes, and two, as an example of progress to others.

As to the first dimension, General Motors has initiated improvement programs and is now engaged in a steady implementation phase—not cosmetic programs, but ones with direct economic benefits. Let me reassure you that General Motors plans to continue to work for social and economic progress. As a recent South African newspaper article pointed out, General Motors was viewed as a catalyst in a new phase of improvements in the working conditions of Africans and Colored in South Africa.

I believe articles such as this indicate that many of the problems have been recognized and defined

—and the issues laid out. There is now more agreement that U.S. companies should remain in South Africa and constructively work to provide opportunities for the Africans and Colored of that country. Progress must be made in South Africa—not on a dramatic confrontation basis with its unlikely promise of success, but on a continuing day-to-day effort through progressive policies, personal contacts, and the like.

I would now like to review GM's efforts in greater detail.

General Motors has a worldwide operating policy of equal employment opportunity. This policy has been implemented to the extent possible in each country in which we do business. While local operating conditions may impinge on the implementation of this policy, GM has initiated affirmative action programs to upgrade its Colored and African employes in South Africa, as we have done for black employes in the United States.

It is the established policy of GM South African that all employes performing like work in like classification with comparable ability and seniority receive equal pay, regardless of race. All employes have an equal opportunity for advancement at GMSA. Any employe can progress to a higher grade depending upon his ability and performance on the job.

Extensive training programs are in operation to broaden the impact of our equal pay policy. Further, our benefit and educational plans are comparable to the best provided in South African industry.

Employment—Hourly and Salaried

Reflecting General Motors continuing efforts, as well as the rapid and expanding industrialization in South Africa, GM South African is a major employer of African and Colored people. Colored and Africans account for 50% of the total work force of 4,800 employes, as shown in Figure 1.

EMPLOYMENT

	Hourly			Total	
	No.	%	Salaried	No.	%
White	1,072	31	1,320	2,392	50
Colored	1,839	53	14	1,853	39
African	551	16	1	552	11
Total Colored and African	2,390	69	15	2,405	50
Grand Total	3,462	100	1,335	4,797	100

Figure 1

These two groups comprise almost 70% of the hourly work force. As to salaried employment, GMSA currently employs fourteen Colored and one African. Effective October 1, 1972, GM South African appointed its first Colored foreman; he had previously completed his pre-supervisory training in the plant. While the number of Colored and African staff is relatively small, it is a start—and, as such, a precedent for further progress has been established.

GM South African hourly employment by work grade classification and race is shown in Figure 2.

HOURLY EMPLOYMENT BY WORK GRADE CLASSIFICATION AND RACE

Work Grade	White	Colored and African		
		Colored	African	Total
1	—	146	196	342
2	3	233	98	331
3	2	326	110	436
4	32	486	99	585
5	5	267	24	291
6	35	107	5	112
7	50	46	4	50
8	139	173	5	178
9	268	55	10	65
10	446	—	—	—
11	92	—	—	—
Total	1,072	1,839	551	2,390

Figure 2

Work grades at GM South African range from Grade 1—the lowest classification—to Grades 10 and 11, which encompass highly skilled jobs to which Colored and African employes have not yet risen. Colored and Africans are employed mainly in the first five grades, while most white employes are more heavily concentrated in the upper grades. However, many Colored employes and several Africans are in these upper grades. Further, GM South African is conducting extensive training programs to upgrade these race groups in the lower classifications for advancement into the more skilled Grades of 6 and above.

A measure of our employment progress is achieved by comparing our current Colored and African hourly employment by grade with the status in early 1971, just a year and a half ago, as shown in Figure 3.

COLORED AND AFRICAN HOURLY EMPLOYMENT BY WORK GRADE CLASSIFICATION

Work Grade	Oct. 1972		March 1971		1972 O/(U) 1971	
1	342		429		(87)	
2	331		677		(346)	
3	436		597		(161)	
4	585		801		(216)	
5	291		297		(6)	
6	112		44		68	
7	50	405	24	193	26	212
8	178		93		85	
9	65		32		33	
	2,390		2,994		(604)	

Figure 3

During this period, total employment for all race groups declined as a result of business conditions. Although total Colored and African employment declined by 604, it is important to note that Colored and African employes in the more skilled Grades 6 through 9 have more than doubled to 405.

Wage Rates

In reviewing South Africa wage rates, one must consider the special factors which have been generally operative in the South African labor market. First, wage rates for particular races have fluctuated with labor availability. As the South African economy rapidly expanded, the wage rates for the generally more highly skilled whites were driven upward and additional Colored and Africans were absorbed into the labor force at the lower paying, less skilled jobs—and at wage rates lower than for whites.

Second, an ability factor exists; rather than a fixed wage for a specific job, a merit increase system allowed a wage differential based on the job performance of individuals doing the same work. Third, a seniority factor is operative; wages for a specific individual reflect length of time on the job.

All these factors worked toward wage rate differentials among the races—forcing the national average for whites far above that for other race groups.

In order to overcome these disparate forces, General Motors South African has initiated a new wage program, very similar to that in the

United States. Under our new program, new employes receive the minimum starting wage for each grade. After the first six months of employment, an automatic increase is granted—with the remaining distance to the maximum wage representing recognition of ability and seniority factors. Promotion to a higher grade is required to receive an increase above the stated maximum for each grade. Considerable additional wage expense has been incurred to reduce the differential between minimum and maximum wage rates.

Figure 4 indicates the wage rates for multi-racial work grades at GM South African. You can see that the average rates for white employes in Grades 5, 6 and 9 are above the maximum. Some employes of all race groups are receiving rates higher than the maximum due to merit increases and seniority under GM South African's previous wage program. Over the next 12 to 18 months, it is planned that the substantial portion of these individuals will fall within the new ranges as a result of training, which will permit advancement to a higher grade.

AVERAGE BASE HOURLY WAGE RATES BY WORK GRADE CLASSIFICATION AND RACE 1972

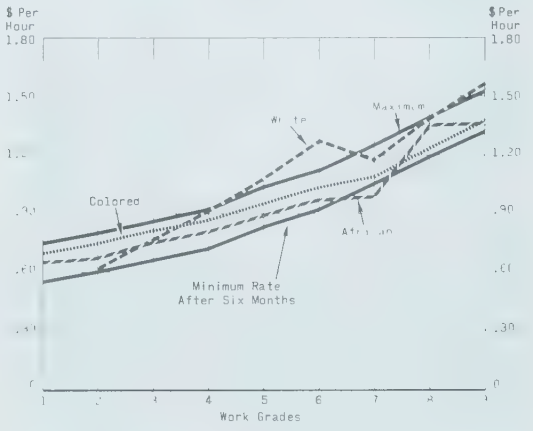


Figure 4

Although there is a gap between the average wage rates for races in comparable grades, considerable progress has been made in raising Colored and African wages and thereby reducing the wage differential between the races. In the past year and a half, Colored and African hourly employes have received an average wage rate increase of 23%—compared with 18% for whites.

In summary, GM South African's new wage system has reduced the wage differential by race in the work grades. It has increased the wages of Colored and Africans in order to establish a standardized wage structure through: (1) narrowing the wage differential paid for a specific job; and (2) initiation of a standard, minimal seniority system.

Another measure of our progress is a comparison of the per capita income increase for South African males, as published recently by a private research group in South Africa, and the increase in wages paid to GMSA males in the last few years. As shown in Figure 5, per capita income for Colored, African and Asiatic males is now increasing at a greater rate than for whites. This trend is reflected at GM South African, where wage increases have exceeded the overall average.

AVERAGE MALE WAGE INCREASES— GM SOUTH AFRICAN VS. OVERALL

	12 Months Ending			Memo: Mar. 1971 to Oct. 1972
	April 1971	Nov. 1971	April 1972	
	%	%	%	%
GM South African				
Colored and African.....	9	15	15	23
White.....	10	11	12	18
Overall Male Per Capita Income				
Colored, African and Asiatic....	8	8	12	18
White.....	11	7	5	7

Figure 5

Since March of 1971, average Colored and African wages at GMSA have increased 23%, compared with 18% for whites. This 23% increase also exceeded the average for all manufacturing in South Africa during the same period.

Other Employment Steps

Several other employment steps have been taken by GMSA to improve communication with its Colored and African workers and to assure its continued progress and identity.

An African Works Committee was elected in the fall of 1971 to represent African employes. This Committee has met regularly with management to discuss matters of mutual interest. In this regard, three African shop stewards have been appointed to represent African employes and

have been given the same privileges and responsibilities as the stewards representing our Colored and white employes.

As indicated earlier, the first Colored foreman at GM South African was recently appointed, and more are expected in the near future. Two Colored hourly employes have also been assigned as quality control inspectors in the body shop. This is the first time that employes other than whites have held these positions at GM South African. All areas are continually under review for further appointments of this nature.

The abilities of our employes are regularly reviewed in order that they can be directed into training programs commensurate with their potential.

Training

GM South African has an extensive range of training programs to upgrade its Colored and African employes and provide a basis for upward job mobility.

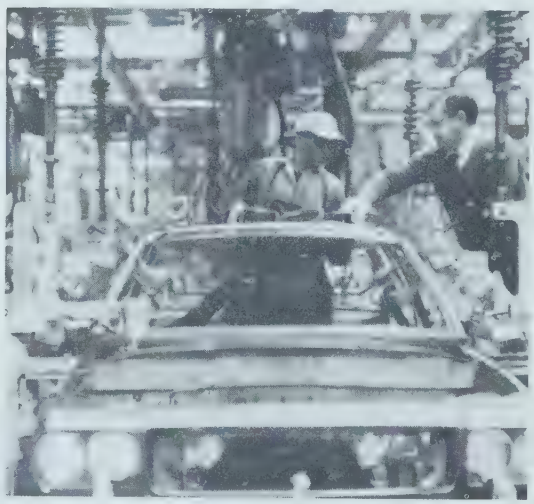


Figure 6

Training for new hires and on-the-job training are provided for all employes (Figure 6). In addition, five specific training programs are in operation, with all costs paid by the company. Fifty-six Colored and African employes have satisfactorily completed literacy instruction in a Basic Training Program, and fourteen more are currently enrolled in this Program.

Thirty-three Colored employes have successfully completed instruction on the first phase of a Technical Training Program, and thirty-nine em-

ployes are taking advantage of the Program at the present time. Eight Colored repair shop assistants are participating in a Workshop Technician Training Program (Figure 7).

Figure 7

Since 1970, 257 Colored and African employes have participated in a Pre-Supervisory Training Program. Twenty-three who completed this training have already been appointed to supervisory positions. It was a graduate of this training program that recently became the first Colored foreman at GM South African. Further, since 1954 the GM South African Service Division has operated a fully equipped Mobile Training Unit which provides instruction to dealer service personnel (Figure 8). Since June of 1971, over 200 Colored, African and Indian personnel have received training on dealer premises throughout South Africa in skills such as sheet metal repair, spray painting and general mechanical maintenance. Later this year, courses will be held in the African homelands, and in 1973 the unit is scheduled to visit Swaziland and Botswana.

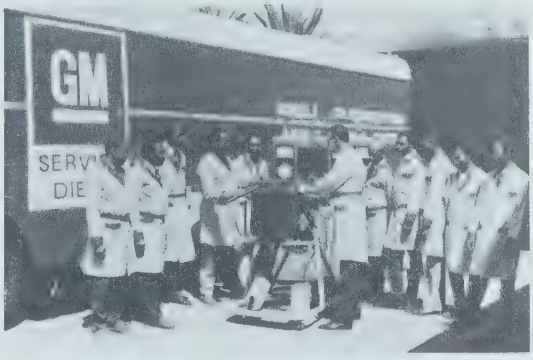


Figure 8

Employe Plans

GM South African's efforts extend into many areas beyond the basic employment relationship. Employe plans apply to all employes, regardless of race. Benefits include group life insurance, medical, sickness and accident, and retirement plans. Improved group life insurance and retirement plans have recently been approved and will be put into effect early next year.

The medical plan also covers dependents of employes, as well as retirees and their dependents. In July of this year, the medical plan was expanded to provide coverage for dental care, routine physical examinations and eye examinations. In addition, all employes receive a thorough pre-hire medical examination, annual chest X rays and emergency medical service. A doctor and four nurses, including one Colored and one African, administer these programs at our facilities.

GM South African benefit plans provide benefits at least equal to the average for all race groups in South Africa and, with regard to Colored and African employes, our benefits are well above those provided by most other companies in South Africa.

As to educational assistance, 29 Colored and African employes are furthering their formal education by participating in the Tuition Refund Plan. In 1972, 124 high school scholarships have been granted to children of African and Colored employes. Further, almost 500 children of our African employes are taking advantage of a bursary plan which covers the cost of prescribed books and school fees for children.

Booklets on these plans, as well as booklets on our training and educational programs, have recently been distributed to our employes.

Outside Educational and Financial Assistance

GM South African continues to render financial assistance to organizations dedicated to furthering the progress of the Colored and African people of South Africa. Reflecting a thorough examination of GM South African's outside educational and financial assistance programs, contributions made to Colored and African organizations this year will represent 43% of our total support, compared with 5% in 1969. (In addition, 34% of total contributions in 1972 were made to organizations representing all races.)

Among the numerous organizations supported by General Motors are the Inanda Seminary for Girls, the South African Institute of Race Rela-

tions, the Association for the Educational and Cultural Advancement of the African People of South Africa, the Bureau of Adult Literacy, the United States-South Africa Leader Exchange Program, and The African-American Institute. In addition, GM South African has contributed through the National Study Loan and Bursary Fund to one Colored and three African universities.

Housing Assistance and Recreational Facilities

GM South African recognizes that the dwellings occupied by many of its Colored and African employes are a serious social problem. Accordingly, meetings have been held with municipal authorities to consider various proposals for housing assistance to our employes.

As a first step, on a priority basis, the company has arranged to loan a number of Colored employes the necessary down payment to buy their homes.

We have also reviewed other ways in which we might improve the social well-being of our Colored and African employes. Through the years, our employes in South Africa have manifested a great interest in athletics. In order to fulfill these needs, the construction of rugby, cricket and soccer fields, a tennis court, a clubhouse and other related facilities in the Colored residential area has recently been approved. After implementation of this project, comparable recreational facilities will be available to our Colored and white employes. In addition, a similar recreational plan for African employes is being considered.

SUMMARY

The South African situation admittedly involves complex issues on which reasonable men can differ. Our continuing approach is to improve the economic status of our employes and to build a climate within which desired changes can be implemented. On this basis, our continued operation in South Africa is consistent with the best interests of our stockholders and South African employes.

Although the South African economy has slowed over the past two years, indications point to an economic upturn in 1973. Similarly, the outlook for the automobile industry in South Africa is favorable. Total vehicle registrations are expected to increase to approximately 300,000 vehicles in 1973. GM South African expects to participate in this growth and to improve its overall market position. In the long-term, South Africa represents a tremendous opportunity for the automobile and commercial vehicle business.

The South African economy offers considerable opportunities for sound economic growth. The African, Colored and Asian sectors of the population should benefit as they become more closely integrated into industrial and commercial life—not only in the African homelands and border areas, but throughout the country. Employment opportunities will improve, and wages and salaries will show a corresponding increase. The fact that white trade unions are allowing other race groups to occupy jobs of greater skill and importance, and the demand by the Trade Union Council of South Africa for recognition of African trade unions indicate these trends toward greater opportunities for all races.

In conclusion, General Motors believes that the steps taken during the last two years represent substantial progress in upgrading our Colored and African employes. As you have seen today, our total program for upgrading our work force is a broad one. The areas on which we can be criticized are steadily being reduced, and I hope in the not too distant future you will be able to join with us in celebrating the attainment of our mutual objective —equal opportunities in South Africa. We will continue to review all areas for further progress. General Motors will remain in South Africa and will continue to be in the forefront of progressive change.

Thank you.

* * * * *

GENERAL MOTORS CORPORATION
DETROIT, MICHIGAN 48202

GENERAL MOTORS CORPORATION REPORT FOR SECOND QUARTER 1973

AR34

PONTIAC CATALINA Hardtop Coupe

GENERAL MOTORS RESULTS IN BRIEF

	1973		1972	
	Second Quarter	Six Months	Second Quarter	Six Months
Sales of All Products (in millions)	**$9,606**	**$19,175**	$8,458	$16,238
Net Income (in millions)	**$ 797**	**$ 1,614**	$ 723	$ 1,374
Earned Per Share of Common Stock	**$ 2.78**	**$ 5.62**	$ 2.52	$ 4.78
United States, Foreign and Other Income Taxes (in millions)	**$ 781**	**$ 1,597**	$ 702	$ 1,347
Worldwide Employment (average)	**813,082**	**810,530**	767,284	766,724
Total Payrolls (in millions)	**$2,577**	**$ 5,126**	$2,187	$ 4,315

	June 30, 1973	Dec. 31, 1972	June 30, 1972
Working Capital (in millions)	**$ 6,617**	$ 5,565	$ 5,324
Stockholders' Equity (in millions)	**$12,704**	$11,683	$11,615

FACTORY SALES OF CARS AND TRUCKS, including export shipments

	First Quarter		Second Quarter		Six Months	
	1973	1972	1973	1972	1973	1972
Manufactured in the United States						
Passenger Cars	**1,483,257**	1,274,842	**1,451,354**	1,365,699	**2,934,611**	2,640,541
Trucks and Coaches	**338,768**	261,406	**337,774**	290,168	**676,542**	551,574
Total United States	**1,822,025**	1,536,248	**1,789,128**	1,655,867	**3,611,153**	3,192,115
Manufactured in Canada	**149,481**	121,962	**167,284**	139,467	**316,765**	261,429
Manufactured Overseas*	**431,794**	359,695	**434,837**	445,066	**866,631**	804,761
Total Canada and Overseas	**581,275**	481,657	**602,121**	584,533	**1,183,396**	1,066,190
Total Factory Sales All Sources	**2,403,300**	2,017,905	**2,391,249**	2,240,400	**4,794,549**	4,258,305
*Includes units manufactured by Isuzu Motors Limited and marketed by General Motors	**9,765**	3,165	**8,524**	13,731	**18,289**	16,896

Principal Offices: Detroit, Michigan; New York, New York

The continuing strong demand for General Motors products in both the North American and overseas markets resulted in near record unit sales during the second quarter of 1973. Worldwide factory sales of GM cars and trucks totaled 2,392,000 units—1,789,000 units in the United States, 168,000 units in Canada, and 435,000 units outside the U.S. and Canada. These factory sales were 7% above the 2,240,000 units sold in the second quarter of last year but slightly less than the quarterly record of 2,403,000 units sold in the first quarter of 1973.

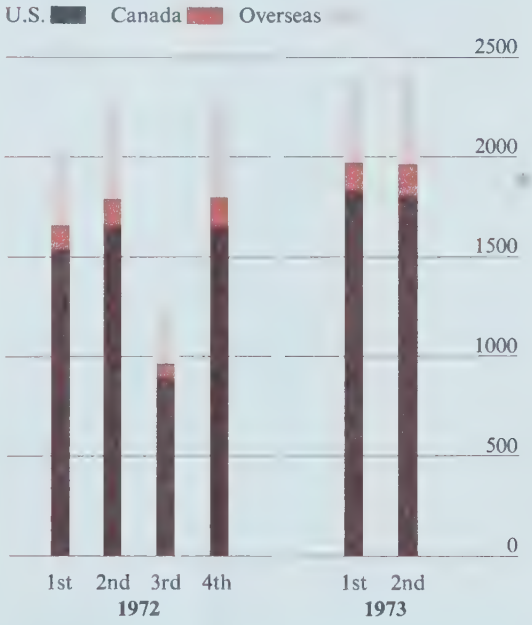
Dollar sales during the second quarter of 1973 were a record, totaling $9,606 million, compared with $8,458 million last year and $9,569 million in the first quarter of 1973.

Total net income for the second quarter of 1973 of $797 million—although $74 million above the year ago period—was $20 million below the first quarter of 1973. The reduction in profit is a result of added labor and material costs and the fact that we have had no price increase this calendar year on North American-built vehicles, offset in part by unprecedented worldwide sales and record profits from overseas operations.

Second quarter 1973 earnings amounted to 8.3% of sales, down from the 8.5% earned in both the second quarter of last year and the first quarter of 1973.

Worldwide employment, payrolls and wages of our employes were at record levels. GM's worldwide employment in the 1973 second quarter averaged 813,000, 6% more than the 767,000 employes in the second quarter of

GM Factory Sales—Cars and Trucks
thousands of units by quarters



1972. Worldwide payrolls totaled $2,577 million for the second quarter of this year, an increase of 18% over the $2,187 million for the same period a year ago and compared with $2,549 million in the first quarter of this year. Wages for U.S. hourly employes of $6.31 per hour were at an all-time high and substantially above the average for all U.S. manufacturing employes.

Earnings per share of common stock for the second quarter of 1973 were $2.78, compared with $2.52 for last year's second quarter and $2.84 in the first quarter of this year.

GMC Truck & Coach Division's RTS (Rapid Transit Series) prototype coach, shown above, is the basis for a new family of transit, suburban, and inter-city coaches that will help expand the nation's mass transit system and compete to replace the more than 21,000 coaches that have been in service for over 15 years. The RTS, scheduled for initial production in late 1975, will be constructed of modules used like "building blocks" to form coach bodies in 35- or 40-foot lengths. The RTS will be powered initially by a diesel engine, but provisions are available to install a gas turbine engine now under development. The new coach evolved from GMC's experimental RTX coach, first introduced in 1968 and tested extensively as an innovative design study in mass transit.

Dividends paid on common stock during the second quarter of 1973 were $1.20 per share, an increase of $0.10 over last year's $1.10 payment. A dividend of $0.85 per share was paid in the first quarter of 1973.

United States, foreign and other income taxes in the second quarter of 1973 totaled $781 million, an increase of $79 million compared to last year's second quarter provision.

The First Six Months of 1973

Worldwide factory sales of General Motors cars and trucks for the first six months of 1973 totaled a record 4,795,000 units—3,611,000 units in the United States, 317,000 units in Canada and 867,000 units outside the U.S. and Canada. These factory sales compared with 4,258,000 units for the first six months of 1972. Dollar sales were at record levels and totaled $19,175 million for the first six months of 1973. For the first half of 1972, dollar sales were $16,238 million.

Net income for the first half of 1973 was a record $1,614 million. During the comparable 1972 period, net income was $1,374 million. For the first six months of 1973, earnings were $5.62 per share, compared with the previous high of $4.78 for the first half of 1972. Dividends paid on the common stock amounted to $2.05 per share in the first six months of 1973. For the first half of last year, dividends totaled $1.95 per share.

United States, foreign and other income taxes for the first six months were also a record $1.6 billion, compared with $1.3 billion a year ago.

Working capital at June 30, 1973, was $6.6 billion, compared with $6.3 billion at March 31, 1973, and $5.3 billion at June 30, 1972.

U.S. Car and Truck Sales

During the second quarter of 1973, retail sales of GM cars and trucks in the United States totaled 1,795,000 units, 8% above the 1,660,000 units delivered last year.

On an industry-wide retail sales basis, including imports, GM accounted for 43.8% of the 4,099,000 cars and trucks delivered in the U.S. during the second quarter of 1973, compared with 44.9% of the 3,695,000 units delivered in the second quarter of 1972 and 43.4% of the 3,750,000 units delivered in the first

quarter of 1973.

Imported car sales also increased during the quarter rising to 15.6% of total industry car volume from 14.0% in the second quarter of 1972. Sales of GM's German-produced Opel amounted to 5.3% of all imports, almost a one-half point gain over the second quarter last year.

During the first six months of 1973, U.S. retail sales of GM cars and trucks totaled 3,421,000 units, 15% above the 2,975,000 units delivered last year. On an industry-wide basis, including imports, GM accounted for 43.6% of the units delivered, compared with 44.0% of the units delivered in the comparable six-month period of 1972.

The strong selling pace for both GM and the industry reflects a broad demand for all types of cars and trucks. For the first six months of 1973, GM and industry unit sales of regular and luxury-type cars were about the same as last year. In the intermediate and smaller-type car sectors, GM retained its leadership with a 29% sales increase over last year, compared with an industry sales increase of 23% for these types of cars.

Canadian and Overseas Sales

Retail sales of GM cars and trucks in Canada and overseas during the 1973 second quarter also increased compared with the second quarter of 1972. Retail sales of 140,000 GM vehicles in Canada were up 26% over the 112,000 units sold during the second quarter of 1972. For the 1973 second quarter, retail sales of GM cars and trucks outside the U.S. and Canada were a record 460,000 units, a 3% increase over the 447,000 units sold during last year's second quarter and an increase of 50,000 units over the record first quarter of 1973.

Employment and Payrolls

The wages for GM hourly employes in the U.S. in the second quarter of 1973 of $6.31 per hour were $0.36 above the second quarter of 1972, reflecting primarily an increase in the cost-of-living allowance from $0.24 in June 1972 to $0.40 per hour in June 1973 as well as the 3% annual improvement factor increase in November 1972.

GM's hourly employes in the U.S. earned an average of $264.92 per week in the second quarter of 1973, compared with $241.54 in the same period a year earlier. They worked an average of 42.0 hours per week in the second quarter of this year and 40.6 hours in the same period of 1972.

The average number of hourly workers in the U.S. during the second quarter of 1973 was 449,000, a second quarter record and 7% above the 420,000 during the second quarter of 1972.

The President's Economic Program

General Motors is encouraged that the Phase IV program the President has outlined, coupled with his objectives of a balanced budget and limited expansion of money and credit, will provide a sound basis for removing all controls by the end of 1973. We are pleased that the President's program can be realized without an increase in tax rates. The President has repeatedly called attention to the need to exercise discipline over Federal expenditures and budgetary balance must be among the top priorities of our economic policy.

The "fundamental pricing rule" of Phase IV relies on profit margin control. This must be considered as only a short-term expedient. Extended for any period of time, this principle would undermine investment incentives, impairing the expansion of output essential both to long-term price stability and to improving living standards.

The President's statement provides for the formulation of detailed price regulations to take effect between now and August 12. It is critical, we believe, that these regulations and related administrative procedures provide for the prompt and even-handed consideration of price increase petitions. Since January 1972, there have been no price increases on GM's North American-built cars and trucks

other than the December 1972 pass-through of costs of Government-mandated safety and emission-control equipment added to 1973 models at their introduction in September 1972.

This record is clearly evident in the Index of Wholesale Prices prepared by the Bureau of Labor Statistics. Between January 1972 and June 1973, the automotive component of the Index has remained virtually unchanged, while the overall Index of Wholesale Prices increased by over 17%. Over this same period, General Motors labor and material costs have increased substantially. These trends are expected to continue in the 1974 model year.

In addition, to meet Government safety standards, a new and costly seat and shoulder belt system interlocked to the ignition is required on all 1974 model cars. New bumper systems will also add to costs.

In March, we said we would hold the line on prices of North American-built vehicles for the remainder of the 1973 model year. We still stand by that statement. We also said that, while we wished we could hold the line still longer, the cost increases we are experiencing and which predictably lie ahead of us, precluded a commitment beyond August 1973. Therefore, consistent with Phase IV pricing principles, General Motors intends to apply to the Cost of Living Council for approval to adjust 1974 model prices.

Prompt consideration of these requests by the Cost of Living Council is essential. General Motors 1974 model trucks will be available for sale by mid-August. New passenger car introductions are currently scheduled to begin in mid-September. In the absence of approved prices, the orderly marketing of these new vehicles is not possible.

General Motors is moving forward into the new model year confident that critical issues of Phase IV will be promptly resolved.

Labor Negotiations

In mid-July, contract bargaining began between General Motors and unions representing more than 425,000 GM hourly employes in the U.S. The current national agreements between GM and the unions may be terminated September 14.

General Motors hopes for settlements without work stoppages that are fair to all concerned—our employes, our stockholders, our customers, the unions and the public.

The Outlook

Consumer demand for General Motors cars and trucks remains strong. If labor negotiations can be completed successfully with no major work stoppages, the excellent sales pace of the first six months of 1973 should continue for the remainder of the year.

Thomas L. Perkins 1905-1973

Thomas L. Perkins, Counsel to the law firm of Perkins, Daniels & McCormack, Chairman of the Trustees of The Duke Endowment and a member of the General Motors Board of Directors, died on June 21, 1973. Mr. Perkins joined the GM Board in May 1965 and was a member of the Finance Committee and the Nominating Committee.

We are grateful for the generous contributions made by Mr. Perkins to the deliberations of our Board of Directors and to the committees on which he served.

E. N. COLE
President

R. C. GERSTENBERG
Chairman

July 27, 1973

Changes in GM Board Committees

On June 4, the GM Board of Directors announced a number of changes in committee assignments and committee memberships following the retirement of Lloyd D. Brace and J. Wesley McAfee under the provisions of the General Motors Director Retirement Policy.

Eugene N. Beesley was elected Chairman of the Bonus and Salary Committee succeeding Mr. Brace, and Charles T. Fisher, III was elected Chairman of the Audit Committee, succeeding Mr. McAfee. John T. Connor was elected Chairman of the Nominating Committee, succeeding Mr. Beesley in that capacity. Mr. Beesley continues as a member of the Nominating Committee.

New committee memberships include the election of Howard J. Morgens and James M. Roche to the Bonus and Salary Committee; the election of Walter A. Fallon to the Audit Committee; and the election of Catherine B. Cleary and Harry Heltzer to the Public Policy Committee.

All officers of the Corporation were also re-elected by the Board, and other committee memberships were continued.

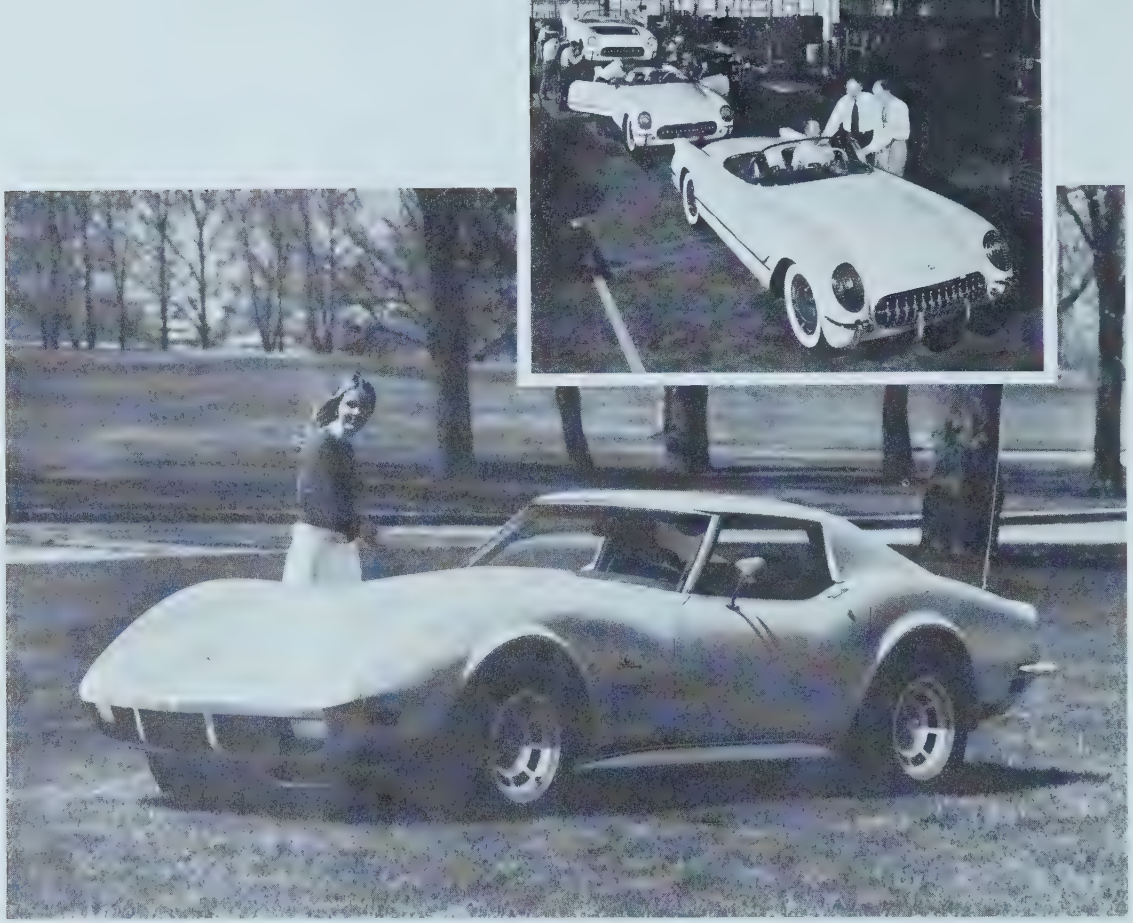
GM Will Meet the 1975 Emission Standards

In his appearance before the U.S. Senate Subcommittee on Air and Water Pollution on May 30, GM President Edward N. Cole stated that 1975-model GM cars will meet the two sets of interim standards of emission control—one for California, the other for the rest of the nation—established by the Environmental Protection Agency in April of this year. In most vehicles, the standards will be met with the use of catalytic converters, which will chemically convert hydrocarbon and carbon monoxide emissions in exhaust gases into harmless carbon dioxide and water vapor. Mr. Cole reported that GM's experience so far with catalytic converters indicated that the emission-control system incorporating converters should improve fuel economy over 1973 levels. GM believes that emission-control systems which include catalytic converters are the best choice of available alternatives at this time from the standpoint of emission control, durability, low maintenance, fuel economy, driveability and cost to the consumer.

In his presentation to the Senate Subcommittee, Mr. Cole also proposed that Congress modify the 1976 standards for oxides of nitrogen emissions. He further proposed that Congress re-examine the original 1975 hydrocarbon and carbon monoxide emissions standards to determine if they are warranted in light of health and environmental considerations.

General Motors has urged the EPA to delay until 1977 the effective date for more stringent controls of oxides of nitrogen. This one-year delay is the only administrative action possible under the law.

(Subsequent to the preparation of this Second Quarter Report, on July 30 the EPA announced a one-year delay in the 1976 oxides of nitrogen standards, but at the same time established an interim standard of 2.0 grams per mile. GM believes that the modified 1976 standards, which still include the original



On June 30, 1953, the first Corvette—a hand-built production model—came off the assembly line at Flint, Michigan. Since then, some 350,000 units have been produced. During the past 20 years, the Corvette has introduced design and engineering features, many of which remain exclusive with the car today. In addition to its steel-reinforced fiberglass body, Corvette was the first modern American car with four-speed manual transmission and the first to have four-wheel disc brakes as standard equipment. The 1973 Corvette, shown above, retains its steel-reinforced fiberglass body and features side-guard door beams; a newly-styled front end that includes a resilient, stronger body-color bumper; improved passenger compartment sound insulation; and standard equipment steel-belted radial ply tires.

extremely low levels set for hydrocarbon and carbon monoxide emissions, are beyond current mass production technology. GM has proposed that the 1975 interim standards the EPA set for the state of California be made the Federal standards for several years, beginning with 1976 models.)

GM and the Energy Situation

General Motors has stated that the nation's overall objectives concerning the energy situation should be to provide the energy the American economy and way of life demand, and to maintain the consumer's full freedom of choice in the marketplace. To this end, General Motors is rededicating its efforts to: (1) improve gasoline mileage in the cars and trucks we build; (2) meet any future increase in consumer demand for smaller, more energy-efficient engines and cars; (3) develop our system for the pollution-free burning of coal; and (4) conserve energy in our plants. GM divisions, more than a year ago, were asked to upgrade their existing energy conservation programs. Since that time, additional emphasis has been applied and every GM plant has

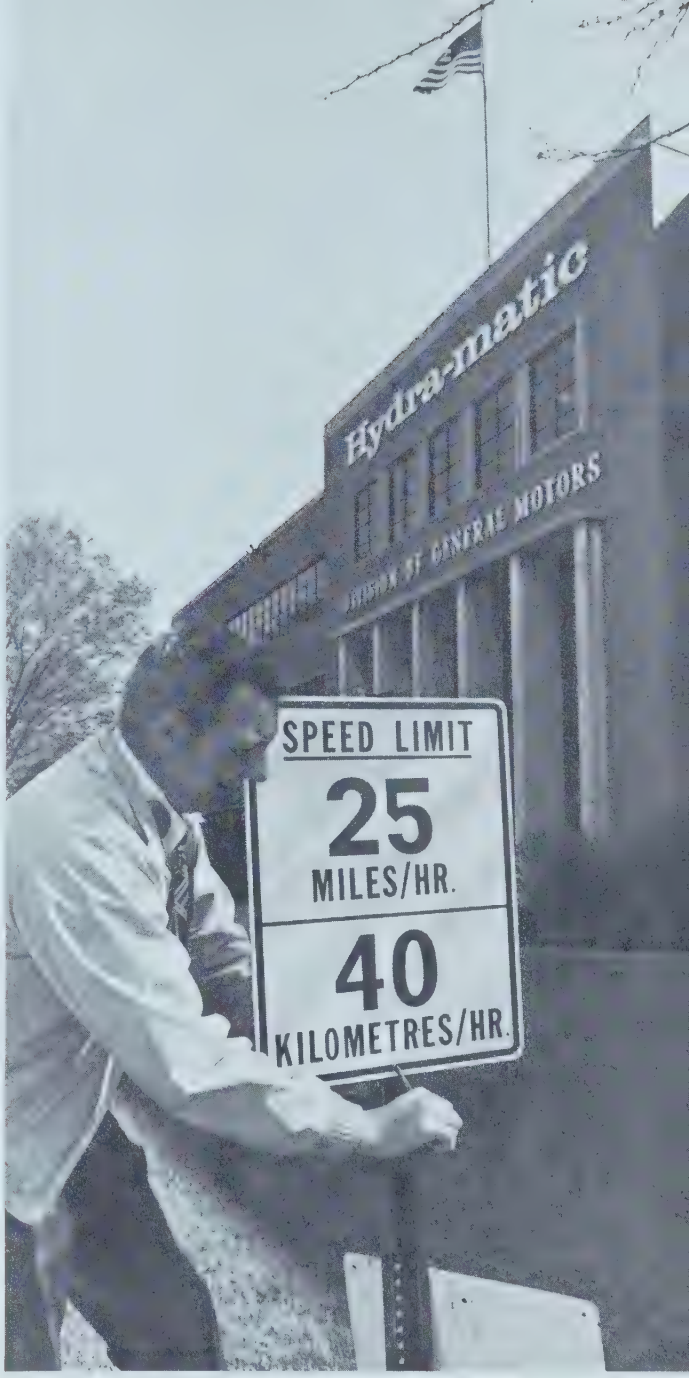
been issued energy conservation guidelines with recommendations on the derivation of an energy savings index. An informational reporting system has been developed to evaluate progress and to keep GM management apprised of corporate energy usage and goals.

GM is also pledging its complete and outspoken support for all reasonable governmental efforts to increase available energy and maintain maximum consumer choice.

In order to achieve the nation's energy objectives, General Motors advocates: (1) the deregulation of the price of new natural gas to stimulate new exploration; (2) an immediate increase in imports of crude oil and refined products; (3) development of Alaskan North Slope oil resources and construction of pipelines as well as supertankers, deep-water ports and offshore terminals to increase the flow of oil into this country; (4) greater domestic exploration and the prudent drilling for oil and gas offshore and beneath public lands; (5) the rapid development and licensing of nuclear power plants; and (6) stepped-up research into possible future sources of energy.

Should the allocation of fuels be necessary for a time, GM favors that petroleum be dedicated primarily to those uses that are geared to it alone, and for which there is no economically feasible alternative. These include transportation, home heating, petrochemicals and certain agricultural purposes. Natural gas should have a higher priority for home heating than for industrial processing uses. The use of either gas or oil as a boiler fuel to generate electricity should have the lowest priority. While maintaining a due regard for the environment, we should remove all possible obstacles that impede the use of coal by electric utilities and large industrial boilers.

In the long run, the design and general



One example of General Motors announced policy of an orderly transition to the metric system of measurement is the installation of new traffic and clearance signs by Hydra-matic Division on its plant property to help employes "think metric." GM's overall metric program includes applying the metric system to new items being initiated for development and converting items now under development to metric terms before completion.

This is the tread design for the GM Specification Radial Tire selected from 23 patterns that were subjected to rigorous tests. The intricate pattern provides an optimum blend of traction, noise and performance characteristics.

adoption of more efficient automotive engines and vehicles can make a major contribution to the resolution of the energy question. General Motors scientists and engineers are seeking to develop innovative answers to the trade-off of gasoline mileage for power devices, air conditioning, heavier bumpers and safety equipment and improved emission controls. These principles and objectives have been presented by GM in testimony before various Congressional committees.

To compete successfully, automobile manufacturers like General Motors must, of course, offer the kind of cars and equipment customers want to buy. Meeting this basic obligation need not be inconsistent with a sound national energy policy if we allow our energy markets to adjust freely to changes in supplies, cost and demand. The combination of consumer choices is almost endless. Car owners can respond to changes in the price and availability of gasoline by adjusting the ways they use their cars and even changing the type of cars they buy. In fact, the public is already responding: the percentage of sales of small and intermediate-size cars is rising and this marketplace trend is being reflected in our production schedules and forward planning. General Motors this year is outselling all others with respect to small and intermediate-size cars in the United States. We are planning to maintain that leadership in meeting customer demands.

GM Tire Improvement Program

General Motors has announced a plan to make a "GM Specification Radial Tire" standard equipment on some 1974-model GM passenger cars and optional on most other 1974 models. The development was conducted over a three-year period in cooperation with five tire companies—Firestone, General, Goodrich, Goodyear and Uniroyal.

The new steel-belted radial ply tire to be provided GM customers will be one that has the optimum combination of a tire's performance characteristics—handling, ride, tread life, endurance, hazard resistance and fuel economy—with significant improvements in traction on wet and snowy roads without perceptible increase in tire noise. The new tire should do much to achieve maximum customer satisfaction with original equipment tires on GM cars.

The GM Specification Radial Tire will carry the tire manufacturer's name. The tire manufacturers will warrant the GM tires, based on their current radial tire warranty practice. General Motors carefully reviewed the tire manufacturers' warranty provisions and customer service programs for the new original equipment tires to be assured that the customers' needs will be better served.

STATEMENT OF CONSOLIDATED INCOME

for the six months ended June 30, 1973 and 1972

	1973		1972	
	2nd Quarter	Six Months	2nd Quarter	Six Months
NET SALES	**$9,605,625,608**	**$19,175,004,397**	$8,457,151,244	$16,237,510,102
Equity in earnings of nonconsolidated subsidiaries and associates	**25,147,399**	**52,530,357**	26,912,974	58,281,659
Other income less income deductions	**43,824,963**	**66,452,379**	7,616,581	22,968,420
TOTAL	**9,674,597,970**	**19,293,987,133**	8,491,680,799	16,318,760,181
COSTS AND EXPENSES				
Cost of sales and other operating charges, exclusive of items listed below	**7,249,437,036**	**14,413,902,782**	6,304,939,626	12,080,304,145
Selling, general and administrative expenses	**328,926,175**	**629,788,365**	290,520,027	572,750,088
Depreciation and obsolescence of real estate, plants and equipment	**240,719,149**	**474,791,182**	220,935,412	444,096,182
Amortization of special tools	**238,265,196**	**486,600,558**	215,947,712	435,347,803
Provision for Bonus Plan and Stock Option Plan	**39,000,000**	**78,000,000**	35,000,000	66,000,000
United States, foreign and other income taxes	**780,800,000**	**1,596,600,000**	701,300,000	1,346,600,000
TOTAL	**8,877,147,556**	**17,679,682,887**	7,768,642,777	14,945,098,218
NET INCOME for the period	**797,450,414**	**1,614,304,246**	723,038,022	1,373,661,963
Dividends on preferred stocks	**3,232,068**	**6,464,135**	3,232,068	6,464,136
EARNED ON COMMON STOCK	**$ 794,218,346**	**$ 1,607,840,111**	$ 719,805,954	$ 1,367,197,827
Average number of shares of common stock outstanding during the period	**286,225,734**	**286,194,809**	286,156,097	286,155,702
EARNED PER SHARE OF COMMON STOCK	**$2.78**	**$5.62**	$2.52	$4.78

Reference should be made to notes on pages 12 and 13.

GENERAL MOTORS CORPORATION

CONSOLIDATED

June 30, 1973, December 31,

ASSETS

	June 30, 1973	Dec. 31, 1972	June 30, 1972
CURRENT ASSETS			
Cash	**$ 390,464,742**	$ 379,618,630	$ 367,709,828
United States and other government securities and time deposits—at cost, which approximates market:			
Held for payment of income taxes	**633,272,185**	603,715,489	481,824,009
Other	**2,589,944,345**	1,963,607,352	2,250,291,483
Accounts and notes receivable (less allowances)	**3,781,212,126**	2,806,202,114	2,920,420,057
Inventories—at lower of cost (substantially first-in, first-out or average) or market	**4,582,697,943**	4,200,163,355	3,609,963,593
Prepaid expenses	**661,229,305**	585,214,833	611,374,766
TOTAL CURRENT ASSETS	**12,638,820,646**	10,538,521,773	10,241,583,736
INVESTMENTS AND MISCELLANEOUS ASSETS			
Equity in net assets of nonconsolidated subsidiaries and associates	**1,327,562,065**	1,141,536,540	1,102,670,384
Other investments and miscellaneous assets—at cost (less allowances)	**93,622,621**	93,256,312	147,514,191
TOTAL INVESTMENTS AND MISCELLANEOUS ASSETS	**1,421,184,686**	1,234,792,852	1,250,184,575
COMMON STOCK HELD FOR INCENTIVE PROGRAM	**113,376,084**	129,540,350	118,867,903
PROPERTY			
Real estate, plants and equipment—at cost	**15,050,508,557**	14,748,057,536	14,573,484,732
Less accumulated depreciation and obsolescence	**9,605,699,164**	9,270,232,890	9,057,030,289
Net real estate, plants and equipment	**5,444,809,393**	5,477,824,646	5,516,454,443
Special tools—at cost less amortization	**668,580,896**	720,699,933	730,867,637
TOTAL PROPERTY	**6,113,390,289**	6,198,524,579	6,247,322,080
DEFERRED CHARGES			
Goodwill—less amortization	**41,237,603**	44,409,726	47,581,848
Deferred income taxes and other	**168,521,080**	127,592,755	87,214,254
TOTAL DEFERRED CHARGES	**209,758,683**	172,002,481	134,796,102
TOTAL ASSETS	**$20,496,530,388**	$18,273,382,035	$17,992,754,396

Reference should be made to notes on pages 12 and 13.

Certain amounts at June 30, 1972 have been reclassified to reflect comparability with classifications at June 30, 1973 and December 31, 1972.

and Consolidated Subsidiaries

BALANCE SHEET

1972 and June 30, 1972

LIABILITIES, RESERVES AND STOCKHOLDERS' EQUITY

	June 30, 1973	Dec. 31, 1972	June 30, 1972
CURRENT LIABILITIES			
Accounts, drafts and loans payable	**$ 2,471,027,127**	$ 2,469,823,840	$ 1,978,748,236
United States, foreign and other income taxes payable	**891,986,343**	760,322,253	766,438,723
Other accrued liabilities	**2,659,035,704**	1,743,600,748	2,172,668,428
TOTAL CURRENT LIABILITIES	**6,022,049,174**	4,973,746,841	4,917,855,387
LONG-TERM DEBT (principally foreign subsidiaries)	**821,057,329**	790,876,437	644,255,793
OTHER LIABILITIES	**343,353,440**	380,365,697	315,314,696
DEFERRED CREDITS AND RESERVES			
Deferred investment tax credits	**176,542,425**	169,838,391	158,932,000
Bonus Plan and Stock Option Plan	**79,877,132**	—	67,205,237
Contingent credits under Stock Option Plan	**14,696,832**	21,100,000	17,714,763
General reserve applicable to foreign operations	**141,667,396**	141,667,396	141,667,396
Other (principally deferred income)	**193,244,401**	112,908,250	114,680,756
TOTAL DEFERRED CREDITS AND RESERVES	**606,028,186**	445,514,037	500,200,152
STOCKHOLDERS' EQUITY			
Capital stock:			
Preferred:			
$5.00 series	**183,564,400**	183,564,400	183,564,400
$3.75 series	**100,000,000**	100,000,000	100,000,000
Common	**479,361,735**	479,360,875	479,360,875
Total capital stock	**762,926,135**	762,925,275	762,925,275
Capital surplus (principally additional paid-in capital)	**766,977,554**	766,945,776	766,822,403
Net income retained for use in the business	**11,174,138,570**	10,153,007,972	10,085,380,690
TOTAL STOCKHOLDERS' EQUITY	**12,704,042,259**	11,682,879,023	11,615,128,368
TOTAL LIABILITIES, RESERVES AND STOCKHOLDERS' EQUITY	**$20,496,530,388**	$18,273,382,035	$17,992,754,396

NOTES TO FINANCIAL STATEMENTS

STOCKHOLDERS' EQUITY: Changes in stockholders' equity during the first six months of 1973 and 1972 are summarized as follows:

	Six Months Ended	
	June 30, 1973	June 30, 1972
Capital Stock:		
Preferred, without par value (authorized, 6,000,000 shares), no change during the period:		
$5.00 series, stated value $100 per share, redeemable at $120 per share (issued, 1,875,366 shares; in treasury, 39,722 shares; outstanding, 1,835,644 shares)	**$ 183,564,400**	$ 183,564,400
$3.75 series, stated value $100 per share, redeemable at $100 per share (issued and outstanding, 1,000,000 shares)	**100,000,000**	100,000,000
Common, $1⅔ par value (authorized, 500,000,000 shares):		
Issued at beginning of the period (287,616,525 shares in 1973 and 287,604,280 shares in 1972)	**479,360,875**	479,340,467
Newly issued stock sold under provisions of the Stock Option Plan (516 shares in 1973 and 12,245 shares in 1972)	**860**	20,408
Issued at end of the period (287,617,041 shares in 1973 and 287,616,525 shares in 1972)	**479,361,735**	479,360,875
Total capital stock at end of the period	**762,926,135**	762,925,275
Capital Surplus (principally additional paid-in capital):		
Balance at beginning of the period	**766,945,776**	766,136,647
Paid-in capital in excess of par value of newly issued common stock sold under provisions of the Stock Option Plan	**31,778**	685,756
Balance at end of the period	**766,977,554**	766,822,403
Net Income Retained for Use in the Business:		
Balance at beginning of the period	**10,153,007,972**	9,276,195,778
Net income for the period	**1,614,304,246**	1,373,661,963
Total	**11,767,312,218**	10,649,857,741
Cash dividends:		
Preferred stock, $5.00 series	**4,589,110**	4,589,110
Preferred stock, $3.75 series	**1,875,025**	1,875,026
Common stock, $2.05 per share in 1973 and $1.95 per share in 1972	**586,709,513**	558,012,915
Total cash dividends	**593,173,648**	564,477,051
Balance at end of the period	**11,174,138,570**	10,085,380,690
Total Stockholders' Equity	**$12,704,042,259**	$11,615,128,368

INCENTIVE PROGRAM: At June 30, 1973, options granted under the Stock Option Plan were outstanding as follows:

Date Granted	Option Price	Shares Under Option	Date First Exercisable	Date Last Exercisable
March 3, 1969	$78.07	189,891	March 3, 1970	March 2, 1974
March 2, 1970	69.82	216,951	March 2, 1971	March 1, 1975
March 5, 1973	73.38	297,588	March 5, 1974	March 4, 1983
Total		704,430		

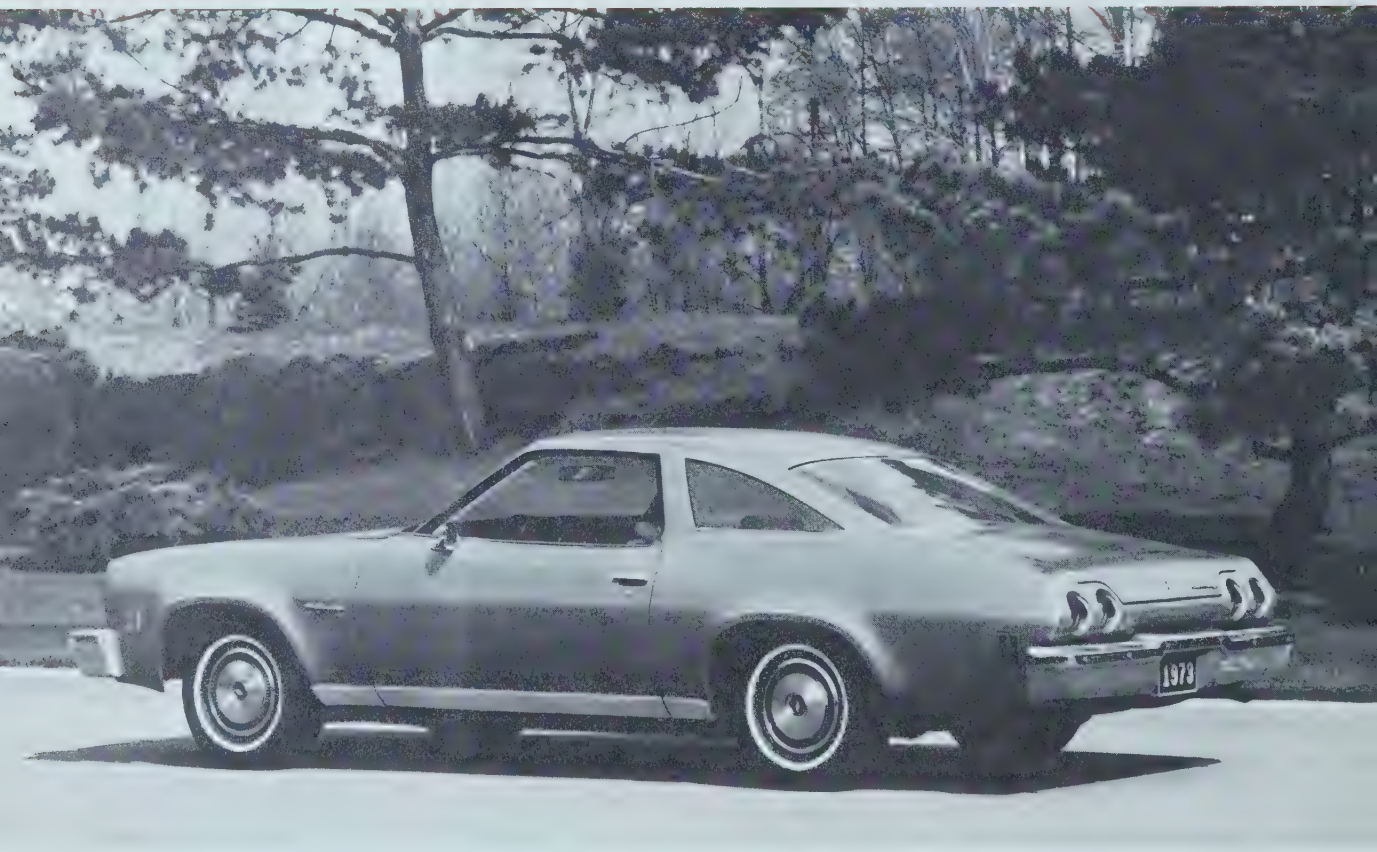
Option prices are the average of the highest and lowest sales prices on the New York Stock Exchange on the dates granted. During the first six months of 1973, executives exercised options to purchase 516 shares of General Motors common stock for $32,638, or $63.25 per share.

The reserve for the Bonus Plan and Stock Option Plan at June 30, 1973 included the provision for the first six months of 1973 and $1,877,132 carried forward from 1972. Common stock held for the Incentive Program at that date consisted of 837,035 shares held for instalment deliveries of bonus awards and contingent credits related to prior years, 185,212 shares available for contingent credits related to outstanding stock options and 482,093 shares available for future bonus awards and contingent credits.

CONTINGENT LIABILITIES: There are various claims and pending actions against the Corporation and its subsidiaries in respect of taxes, product liability, alleged patent infringements, warranties, alleged air pollution and other matters arising out of the conduct of the business. Certain of these actions purport to be class actions, seeking damages in very large amounts. The amounts of liability on these claims and actions at June 30, 1973 were not determinable but, in the opinion of the management, the ultimate liability resulting will not materially affect the consolidated financial position or results of operations of the Corporation and its consolidated subsidiaries.

GMC Truck & Coach Division's versatile six-passenger pickup can be used to carry work crews and cargo, for family transportation and hauling, or it can be equipped to accommodate a slide-on camper or pull a travel trailer.

GENERAL MOTORS CORPORATION
DETROIT, MICHIGAN 48202



CHEVROLET CHEVELLE MALIBU Coupe

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Report of the 65th General Motors Stockholders Meeting

COBO HALL
DETROIT, MICHIGAN
FRIDAY, MAY 25, 1973

It is with pleasure that we report to the stockholders of General Motors the proceedings of the 65th Annual Meeting of Stockholders held May 25, 1973, in Cobo Hall, Detroit. The meeting, which convened at 1:00 p.m. and adjourned at 5:27 p.m., was attended by over 700 persons from 18 states as well as from Canada and Japan.

There were 235,460,191 shares of GM common stock represented at the meeting, or 82.2% of the 286,363,539 common shares outstanding. Also, 775,640 stockholders, or 60.9% of the 1,274,635 eligible stockholders of GM, were represented either in person or by proxy.

R. C. Gerstenberg

CHAIRMAN

THE 65th Annual Meeting of General Motors Stockholders was called to order by Richard C. Gerstenberg, Chairman of the Board of Directors, who presided. Mr. Gerstenberg welcomed the stockholders present, then introduced those who were seated on the dais with him: Edward N. Cole, President; Thomas A. Murphy, Vice Chairman; Ross L. Malone, General Counsel; and Calvert Thomas, Secretary.

Mr. Gerstenberg reported that the following changes had been made in the By-Laws since the last annual meeting: the portion of Article 38 of the By-Laws, dealing with the scope of the audit to be made by the independent public accountants, was modified at the suggestion of a stockholder to make it clear that the auditors have the responsibility to recommend the scope of the audit and that the Audit Committee has the responsibility to review this recommendation to assure that the scope of the audit is sufficiently comprehensive. Also, the By-Law pertaining to the number of directors had been amended during the year, most recently in April, 1973, when the number of directors was reduced from 27 to 25 effective upon the election of directors at the 65th Annual Meeting. Mr. Gerstenberg also stated that there had been other minor changes made in the By-Laws which involved the size of Board Committees and the designation of associate and assistant general counsels.

Mr. Gerstenberg asked those present to join with him in a moment of silent tribute to Mr. Charles Stewart Mott, a director for 60 years, who died on February 18, 1973. On behalf of the stockholders, Mr. Gerstenberg extended his sympathy to Mrs. Mott, who was in attendance.

The Chairman noted that two current directors—Mr. Lloyd D. Brace and Mr. J. Wesley McAfee—were not standing for reelection, in accordance with the provisions of the General Motors Director Retirement Policy. Mr. Gerstenberg introduced Mr. Brace and Mr. McAfee and paid tribute to their contributions as directors. He then introduced the directors standing for reelection, all but one of whom was in attendance.

Following the introduction of directors, Mr. Gerstenberg outlined the rules governing the conduct of the meeting, making note of the change in format suggested by two stockholders which provided the opportunity to ask questions relating to the business of the Corporation prior to acting on items submitted by the Board. Mr. Gerstenberg then made his report on the state of the business.

CHAIRMAN'S REPORT ON THE STATE OF THE BUSINESS

It gives me the highest personal satisfaction to be able to report to you, the owners of General Motors, what your company, with your support, has been able to achieve in 1972. Last year, in almost every respect, was the most successful in our long history —and we expect this year to be even better.

We should evaluate the state of General Motors today against the perspective of our recent history. Today's unprecedented business successes—the record sales, the record earnings, the record wages —these have all been accomplished even while we are responding to the pressing social concerns, the demanding public expectations, and the growing governmental regulation that characterize our times.

A further measure of the well-being of your business is our confidence in the future. That future is full of bright, almost unlimited, opportunities, and we are sure that General Motors, more than any other company, has the readiness and the resources to grasp these opportunities.

No one is more aware than your management of the public concerns that are being so loudly voiced about the American automobile business and its prospects. And no one should doubt the extent of our efforts, the depth of our resolve, or the fullness of our commitment to meet public objectives for cleaner air, greater highway safety, and cars that are easier to repair and maintain.

The achievements of General Motors in these areas should be measured against the objectives we have set and the progress we have made toward their attainment.

Now, this afternoon, I must say that none of these objectives can be said to be fully attained—not yet. Indeed, some tasks, such as safety and customer service, can never be completed, set aside, and labeled finished business. But it must be said that enormous progress has been made—and is being made.

Meeting the Standards

Consider, for example, the progress in emission control. The GM cars rolling off our lines today, and for the past few years, have emission levels so low that the nation's air is actually becoming cleaner even though the number of cars on the road is increasing. Now before us are the emission standards for 1975. These will be difficult to attain—not so difficult in the laboratory; we and others are doing that—but extremely difficult in mass production. We must build more than 25,000 vehicles every day, with a variety of engine sizes, and all with emissions so low as to be almost beyond measurement. No one, no one yet, has ever done that—and now your company is preparing to do just that.

The 1975 GM cars will meet the two sets of standards of emission control established last month by the Environmental Protection Agency—one for California and another for the rest of the nation. The majority of our 1975 cars will have new carburetion and ignition systems to maintain or improve fuel economy and engine performance; some will need air pumps, and in most cases—perhaps all—catalytic converters may also be necessary or desirable.

To attempt to meet these tough standards within

the time available without catalytic converters might mean, in many cases, further losses in fuel economy and engine performance, and less assurance that the required emission levels could be maintained in the field. As against this, the addition of the converters to our advanced control systems provides stronger assurance of compliance and, based upon the limited testing to date, no loss of fuel economy (perhaps even an improvement), and better performance. Because different equipment will be required on different models, the increases in cost will vary. We now estimate that, should catalysts be installed on all 1975 cars, an average retail price increase in the area of $150 would be required for all the added equipment including the catalyst just to recover the cost to General Motors. If only some of our cars should be equipped with catalysts, the average price increase would be something less.

The ability to mass-produce these sophisticated control systems, as we will be doing by the fall of next year, represents a considerable technological accomplishment. Your Corporation is proud of the leadership role we have played in it.

As for the 1976 standards, we have consistently maintained that the requirement for controlling oxides of nitrogen emissions was overly stringent—and indeed beyond our present capability of meeting. Now, the EPA has come to agree that the 1976 NO_x standard is too stringent and is urging Congress to modify it. We will soon apply to the EPA to ask that the 1976 NO_x standard be deferred until 1977. A prompt decision on this important and critical matter would be of great help to us in charting our course beyond 1975.

Achievement of an Objective

We wish these costs, which must be reflected in prices, were not necessary. We hate to add even a nickel to the price of our products. Nevertheless, the cars of these years, as they replace older cars, will achieve the objective GM announced in 1969 of taking the automobile out of the nation's air-pollution problem—a truly historic achievement.

I might add that our President, Mr. Cole, will appear before Senator Muskie's Subcommittee on Air and Water Pollution on Wednesday, May 30, where he will discuss this subject of emission control in full detail. And I would like to take this occasion to congratulate Ed and his people publicly for their great job in a most difficult area.

Today, we should consider, too, the great recent advances in automotive safety. Many of these, such as collapsible steering columns and side-guard door beams, were pioneered by General Motors before Federal standards. Today, virtually every car on the road is equipped with seat belts, and about half have shoulder belts. These provide an enormous potential safeguard to the driving public. There they are, ready to be used, right now. If they were used by every driver and every passenger every time, the highway death toll would be markedly reduced—right now, overnight.

To encourage greater usage of safety belts, the government has directed that the 1974 cars be constructed so they cannot be driven until the combination of both lap and shoulder belts are buckled over the driver and front-seat passenger. In complying with this standard, we have significantly improved the design of our belt systems so they will be more

comfortable, and any inconvenience to the wearer will be far outweighed by the greater protection he gains.

This 1974 safety-belt system will be another of the great advances in automotive safety which, together with better highways and improved driving, have cut the highway death rate in half since the end of World War II, even as the number of cars on the road has more than tripled, and driving speeds have significantly increased. GM is continuing to maintain leadership in the development of the air-cushion restraint system and, along with other manufacturers, is testing air cushions in the field.

We should keep in mind that, even while such great technological advances in emission control and automotive safety are being made, your Corporation is posting the best sales and profit performance in its history and is still cooperating fully with the Administration's anti-inflation efforts.

Last year's earnings were an all-time high, although by a narrow margin, and the common stock dividend of $4.45 per share, even though within the government's guideline, was still the third highest ever. Over the past ten years, the percentage of these dividends to earnings has ranged as high as 163% in the strike-affected year of 1970, and as low as 51% in 1971. Yet for the ten years as a whole, better than 70% of earnings were paid to stockholders in dividends. In the second quarter of this year, a special dividend of 35¢, added to the regular 85¢, made for a total dividend of $1.20. The dividends for the first half of $2.05 per share are 10¢ above a year ago.

Solid achievements in both sales and earnings are spelled out in the Annual Report for 1972 and in the First Quarter Report for 1973. The unprecedented demand for General Motors products has carried over into the second quarter, now more than half over.

Foundations for the Future

Our analysis of the market and our conversations with dealers confirm a very strong underlying demand. Both employment and consumer incomes are rising. In spite of inflationary pressures, most families are better off now—that is, their real incomes are higher—than they were a year ago. GM's products represent outstanding value, and our customers are recognizing this. Finally, and I would like to emphasize this, these sales are solid evidence of the importance people attach to their personal transportation by car and of the contribution of trucks to our economic system. These are the unshaken foundations of our business.

This strong underlying market sets the stage for this year's record sales prospects in the United States. If there are no work stoppages, we expect that total vehicle sales for the industry in 1973 will go well above the 14¼ million projection we made when the year began—and possibly reach better than 14¾ million units. That would be 11¾ million cars and 3 million trucks—both all-time records.

Furthermore, all present indicators point to a continued strong market next year. We expect general business, employment, and income to keep rising. As we come closer to the full utilization of the nation's manpower and capacity, however, it is likely that the rate of increase will moderate. In line

with this, we expect 1974 vehicle sales in the United States to hold at near-record levels. These will be only slightly below the 1973 pace, but they will be well above sales in any other year in the history of the industry. And, with prices of imported cars increasing sharply, we look for a decline in their share of this surging American market and a corresponding gain for American-built cars.

Let us also look at these figures in the perspective of recent history. I well recall the enthusiasm with which we once announced that industry sales had passed the 10 million mark. That was 1965—less than eight years ago—and truly a landmark achievement. Yet in 1971 we surpassed this by 13%, in 1972 by almost 25%, and this year we expect to pass it by 35%. The landmark of 1965 is far behind.

This sales growth is a compelling answer to those who are so quick to write the epitaph of this industry and who sometimes say the people's love affair with the automobile is over. Well, I think they're all nuts. Never in the entire history of this industry have so many men and women evidenced so strong a desire for personal transportation and so great an ability to afford it.

The growth in truck demand has been remarkable. Business is finding new uses for special-purpose trucks, but equally remarkable are the many adaptations of the truck chassis to the recreational needs of families. These developments are opening up entirely new dimensions for our business, reaching from our small vans, through our half-ton pickup trucks, to our new line of motor homes.

I hope all of you who have not already done so will examine the handsome new GMC motor home which we have displayed in the exhibit area down the hall. It is the newest and, we think, the best vehicle of its kind. Judging by the orders we are receiving, a great many customers think so too.

A World of Opportunity

Undeniably, Americans today are buying more cars, of a wider variety and are driving them more than ever before. Our principal product has broadened rather than narrowed its usefulness, and today is more than ever an integral part of American life.

The bright appeal of this automobile, however, does not stop at our borders, but instead is matched by the opportunities all over the world. Literally a world of opportunity is open before us. I am glad to be able to report that your Corporation is competing strongly in all the significant markets of the free world. In Germany, for example, our Opels are outselling Volkswagens. In Latin America, Africa, and Asia we are introducing new cars and new types of vehicles to meet the varying demands. Last year 14% of our revenues came from overseas and 17% of our capital expenditures were invested overseas. Our overseas sales in 1972 were the highest ever. We expect them to be higher this year—and even higher next year.

General Motors is deeply committed to serving the growing world market. This commitment spans a period of almost 65 years. We have always been eager to compete all around the world. We have wherever we could, and we have succeeded.

Today, General Motors is still aggressively seeking new opportunities. This is in your best interest,

as the owners of the business, and it is in our country's best interest. Since the end of World War II, General Motors' contributions to our nation's balance of payments have totaled over $14.1 billion. Last year alone, General Motors operations contributed a net inflow of about $400 million.

Investing in Opportunity

We plan to continue to invest and build, for you, all around the world and here at home. The dollars we invest tell of our confidence: last year, our worldwide capital expenditures were just under $1 billion. This year, we expect to invest $1.2 billion—and next year even more. Capital expenditures overseas will go from $160 million last year, to $250 million this year, and increase still further next year. This is growth. This is response to opportunity. This is the GM way.

Here at home, our outlook for the rest of this year is predicated on our conviction that there is no need for a strike in our industry in this contract-negotiation year. We agree fully with Mr. Leonard Woodcock, the president of the United Automobile Workers, that 1973, unlike 1970, does not hold the same built-in factors that fostered the strike of that year. Our employes have been protected against inflation; they are sharing in the continuing productivity of the country, and today they are the most highly compensated and best protected workers in any major manufacturing industry in the world.

We want to help preserve and protect the General Motors employe's place among the world's industrial elite. Here in this Hall, earlier this year, I invited the leadership of labor, by a demonstration of reasoned responsibility, to join in making 1973 a milestone—a year that will mark a new attitude and a new approach in our relationship. Today, I repeat that invitation, and I reiterate the hope for a new relationship with our unions—a relationship based on our shared interest in the well-being of our company and our nation, and the fundamental truth that labor and management have far more in common than in conflict.

The Prudent Use of Energy

In looking ahead, we have also to note that we have a serious energy problem in the United States today. I do not, however, believe it appropriate to refer to it as a crisis. A crisis suggests we have reached a turning point, and that our very survival may be at stake. This is simply not so. Instead, I choose to think that we have arrived at a warning marker on our journey along the road of technological and industrial progress. The marker does not say stop, nor does it say turn back. What it does say is simply this: proceed with care—care for the wise management and utilization of the world's supply of fossil fuel, and with diligent attention to the development of the technology to produce—domestically—the energy we will require in the next century.

The fuels we need to power our plants as well as our cars may become more expensive—and temporary shortages may even occur—until the available supplies catch up with the demand. It behooves all of us, therefore, to become more conscious of energy and more prudent in its use. Accordingly, we are taking steps to remind our cus-

tomers of the good driving habits and practices that will maximize gasoline mileage. For example, I would urge everyone to drive more slowly, to form car pools wherever practical, and to properly maintain their cars because all these are proven measures of conserving fuel.

Our hopes that a strike can be avoided, that our economy will remain strong, and that other national problems such as the energy shortage can be handled, all support the strong optimism we feel for the future of our nation and our business.

Your company's prospects are further assured by our continuing innovation. General Motors developed, to choose a topical example, the inertial guidance system which has guided our astronauts in space and jetliners across oceans. Even as I speak to you, our astronauts are being guided toward their Skylab by this remarkable GM development. It has an uncanny accuracy, roughly equivalent to throwing a baseball from the pitcher's mound over here in Tiger Stadium in Detroit to a catcher at home plate in Wrigley Field in Chicago.

GM: Leader in Transportation

Your General Motors is more than an automobile company, more than a truck company. We are in the transportation business, and we have innovations in this broader field as well. We know the nation's urgent need for transportation systems that meet the needs of everyone, suburbanites and city-dwellers alike. We compete vigorously in the manufacture and sale of buses as well as locomotives, and we support efforts to increase funding for public transportation.

Earlier this month, we committed more than $32 million to produce a wholly new family of transit, suburban, and inter-city buses at our GMC Truck & Coach Division in Pontiac. Their new design makes them more adaptable to the requirements of the marketplace. This new family of coaches will be available in about two years, ready to help expand the nation's transit systems and compete to replace the more than 21,000 coaches now in the field that are more than 15 years old.

Our Electro-Motive Division is now building 40 new passenger locomotives for Amtrak. It is continuing the development of all-electric locomotives, and is working to develop a new kind of locomotive for commuter service that will have all its heating and air conditioning powered by electricity generated by the main engine rather than by conventional steam-generating equipment.

In the exhibit area down the hall, you can inspect examples of other GM product innovations and developments. If you haven't seen them, I hope you will. You will see, for example, the Frigidaire Touch-N-Cook range, regarded as the appliance innovation of the decade and an industry first that brings computer technology into the American kitchen.

You will also see in that exhibit hall the General Motors rotary engine. The rotary has the significant advantage of reduced weight and size over conventional engines—an important consideration in our future product planning. I must add that it also has some disadvantages which we are working to eliminate—but the promise is there. It is worth a good hard look, and we are giving it that. We plan to have our first GM rotary-powered cars in Chevrolet show-

rooms in the late summer of next year.

We also have a major gas-turbine program under way in General Motors. Eighty-three prototype turbines are now being field tested. The gas turbine is approaching commercial application for trucks, for buses, and for other heavy-duty uses. This type of engine still presents many problems for passenger car use, but we are optimistic that considerable progress can be made, and we are continuing our research.

Innovations in General Motors are not confined to our products. Every day we are seeking—and we are finding—new methods of manufacture, new materials, new ways to assure greater quality and customer satisfaction. We are innovating in more effective management of our employes, and in ways to accelerate our progress in providing equal employment opportunities for minorities and women.

Looking Ahead in GM

We are also innovative in our planning activities. We are now in our second year of a significant five-year expansion of our research capability. We are looking ahead in General Motors — all of us — as far ahead as reasonable men can see — ten years, twenty years, all the way to the 21st century, now less than a generation away. We are eager to learn what kind of a world this will be; what will be the place of General Motors in this world; what will be the kinds of transportation; what will be the power sources; what will our nation, our world, and our society expect of this company; what opportunities will it hold for us?

All this is meant to assure that your Corporation will maintain its leadership. We are changing as all who would grow must change. We are changing as our times require change. And while sometimes the pace of change may be faster than our ability to respond, we more often find ourselves ahead of our times—or shaping our future even as it happens.

So, I report to you this afternoon on the state of your company. I find it—and I think anyone will who cares to look—in a state of readiness for the great tasks of today and tomorrow. Your company, our company, has grown great by meeting the needs of its society. Its greatness will surely endure, because General Motors, I am sure, will continue to meet the needs of every country and every community in which we operate.

Should, as the years unfold, the need be for more cars, your company, General Motors, will build them. Should the need be for smaller or different types of cars, your company will build them. Should the need be for other forms of transportation, your company will build them. Should the tasks of our times require a certain kind of men and women, General Motors will have them. Should the times require greater resources, General Motors will have them. For we are fully prepared—indeed we are committed—to be equal to all the opportunities of our future.

Confidence Confirmed by Progress

I, for one, have known General Motors all my working life. I have seen our company grow and prosper against competition, and through depression and wars. My association with General Motors has developed within me an unquestioned confi-

dence in its future. My confidence in our company, in General Motors, is born in the knowledge of what it has done in the past, and confirmed in the fact of what it is doing today.

Yours, remember, is the company that, more than any other, gave our country the wheels that have carried it to a prosperity and an abundance unmatched in all the world. This is the company whose inventiveness, daring, and innovation have over the years revolutionized the auto industry, even as, in another time, it developed the diesel locomotive that revolutionized the railroad industry. This is the company whose abilities and resources have enriched the lives of almost every American. And this is the company, again so daring and with skills so subtle, that has guided man to the moon and beyond —and unerringly brought him safely home again. And this company is yours—and mine.

Speaking for your management, we will, in service to the interests of all of you who own our business, of all who draw from it their livelihood, of all who depend upon its products, and of all the communities and countries where GM lives, in the interests of all of these, we will, God willing, continue to move this great company forward.

At the conclusion of the Chairman's remarks, the meeting was opened to questions from stockholders relating to the business of the Corporation.

DISCUSSION

During this portion of the meeting, and that which followed, the following stockholders and proxyholders spoke: Mrs. Helen Dean Bowles, Mr. Jesse Cage, Mr. Edward C. Calvert, Mr. Henry W. Cooper, Mr. Robert Coyle, Mr. Thaddeus Damon, Mrs. Evelyn Y. Davis, Mr. Lowell Dodge, Mr. Christopher Dulakis, Mr. Lewis Gilbert, Mr. Anthony Kassab, Mrs. Ann Lawhead, Mr. Paul Neuhauser, Dr. Gilbert C. Norton, Mr. Daniel Richardson, Rev. Richard Righter, Mr. Waldon Sieh, Mr. George S. Sitka, Mr. Timothy Smith, Mrs. Wilma Soss, Mr. S. Stocker, Mr. Francis Svendrowski, Dr. Irwin W. Tucker, Ms. Mary Grace Weckesser, and Mr. Alex Wisniewski.

A stockholder asked if it would have been possible to pay higher dividends if there had not been a government ceiling on dividend payments. Mr. Gerstenberg replied that the restriction limited dividends to $4.47 per share in 1972, and that GM paid $4.45 for the year. He said that GM had a record earnings level in 1972 and that as recently as 1970, GM paid a dividend of $3.40 per share at a time when the Corporation earned only $2.09 per share due to the UAW strike. He mentioned that there was need to restore capital to what was felt to be a more normal level and that this need may have precluded the declaration of more than the $4.45 per share that was paid out.

A stockholder raised two questions — the first relating to whether General Motors would pay a ransom to rebels, similar to what had been done by the Ford Motor Company in Argentina, and the second dealing with the presentation of a Cadillac to Mr. Brezhnev last year. In answer to the first question, Mr. Gerstenberg said it was not an appropriate subject to discuss at an annual meeting. In answer to the second question, the Chairman stated that the Cadillac was given to the U. S.

Government, to be in turn given to Mr. Brezhnev, as a matter of sales promotion.

Another stockholder asked if GM could build a cleaner engine without the use of a catalytic converter and if the Corporation was going to build a truck plant outside of Tulsa, Oklahoma. Mr. Cole said he would testify before the Senate Subcommittee on Air and Water Pollution on May 30, and he hoped some clarification would result.* In answer to the second question, Mr. Gerstenberg stated that GM had acquired some property in Oklahoma, but there were no immediate plans to build anything there.

A proxyholder complimented General Motors on disclosing information on its operations in South Africa, and asked if there was a target date for conversion to the new wage scale so that all employes at a given level would fall within the ranges established under a new wage program. Mr. Murphy stated it was difficult to set a date, but that GM is working as aggressively as possible to upgrade those people who are now above the maximum hourly wage rate for their grade and to train these employes so they can qualify for a higher grade. The proxyholder then asked if it was possible to provide information on the wages paid at the Impala Platinum Limited mining operation from which GM will obtain its supply of platinum and palladium for use in catalytic converters. Mr. Murphy said the cost per black laborer to Impala for wages and food had ranged from $50 to $142 per month. Impala subsequently advised GM that these costs had increased by 50%. Mr. Murphy went on to point out that, while a breakdown of these costs is not available, the cash wages are a small part of the total compensation because workers also are provided housing, clothing, medical attention, etc. The workers are brought in from other areas of Africa after voluntarily signing contracts for a specific period of time. Mr. Murphy further stated that the fortunate part of the situation is that this represents an improvement — workers are able to save money and go back to their home country and contribute to progress there.

In a further discussion on GM's contract with Impala Platinum Limited, a proxyholder asked if GM considered a $50 per month wage paid to African workers to be adequate. Mr. Murphy said that in the context of Africa today and of the mining industry, he was satisfied with Impala's programs. He concluded by saying that GM does not own the mines, but that it does have a contract with Impala and that General Motors is fulfilling its part of the contract.

In reply to a question asked by a stockholder on advertising, Mr. Gerstenberg stated that in 1972 General Motors spent $217 million in the U. S. and Canada, which was less than 0.7% of sales, and was below the $227 million spent in 1971. He also stated that overseas advertising in 1972 amounted

*A copy of Mr. Cole's presentation is available to stockholders upon request. Write to: General Motors Corporation, 1-101, General Motors Building, 3044 West Grand Boulevard, Detroit, Michigan 48202.

to about $60 million. This same stockholder also asked the Chairman to discuss the small car market. Mr. Gerstenberg replied that there has been a decided shift in the marketplace from the larger to the smaller size car. Mr. Gerstenberg mentioned that in 1965 the small and intermediate size cars accounted for about 30% of GM sales. Today, these size cars account for over 50%. The stockholder also asked for some clarification on a Federal Trade Commission story that GM ads were misleading. Mr. Malone replied GM was one of several companies asked to furnish the FTC with supporting documentation on ads and that there were two with which the FTC was not satisfied. One was a portion of an Opel ad which GM documented and supported. The FTC did not agree and GM is litigating the question. The second ad was on the Vega. The editor of "Car and Driver," after he first drove the Vega, wrote without any instigation from GM that it was the best handling American car he had ever driven. GM included this statement in the ad and proved that the statement was made and published. The FTC, however, took the position that GM has to prove that the Vega is the best handling car in the U. S.

In reply to the first of two questions raised by a stockholder, Mr. Cole stated that GM was familiar with the Honda approach to eliminating vehicle emissions. He said GM engineers had been to Tokyo to review the Honda system, that Honda had installed one of their systems in a Chevrolet Vega, and that GM is currently testing cars equipped with stratified-charge engines. The stockholder then asked why GM does not import the Opel Rekord, produced by GM in Germany. Mr. Gerstenberg replied that GM has been importing other Opel models for a number of years and that the Corporation would like to bring in more models if they would sell in the U. S. However, cars made in foreign countries and sold in the U. S. must be modified to meet U. S. safety and emissions standards and this requires a substantial sales volume to offset the cost of equipment and tools to do that.

A stockholder asked the Chairman to comment on a recent statement made by the Chairman of the New York Stock Exchange that corporations should seek government approval to increase dividend payments to make common stock more competitive with other types of investments. Mr. Gerstenberg replied that the dividend guidelines suggested by the government were made at a time when both wages and prices were controlled and that when prices are controlled so, in effect, are profits. Mr. Gerstenberg stated that as a matter of general principle we would be better off without controls but we recognize the need for controls at the present time. The stockholder then requested the Board to consider declaring a dividend that would be paid if there were no controls, but to only pay out a dividend based on the control guidelines. The difference in the two dividends then could be put in escrow for the stockholders for payment when the dividend-ceiling payment is lifted. Mr. Gerstenberg stated that this request would be noted by the Board.

In reply to a series of questions, Mr. Gerstenberg stated that: the Watergate situation had no direct bearing on the affairs of General Motors; two of

GM's pension trustees had Equity Funding investments totaling about $1.7 million out of a total Pension Fund of about $4.5 billion; General Motors does not sell or lease cars directly to government officials at special rates but does lease a limited number of cars to the Federal Government; GM contributed $8.6 million for educational purposes and $8.8 million for charitable purposes during 1972; the tuition paid by students at General Motors Institute is not sufficient to cover the total costs of operating the Institute, with the added costs of around $10 million paid by the Corporation; in 1972, between $2 to $3 million were paid to cover the operation of GM's Tuition Refund Plan for employes; Mr. John Z. DeLorean resigned to take a GM dealership, something he had planned for some time; and that GM is aware that the Soviet Lada automobile is being sold in some European countries.

A stockholder then asked for the Chairman's comments on a recent *Wall Street Journal* article that dealt with Ford Motor Company's efforts to surpass GM. Mr. Gerstenberg replied that he was familiar with the article and that he had sent it to GM's top 25 executives to read. He mentioned that many years ago, Ford was number one and it was only natural that they try to obtain the number one position again. He pointed out that GM's profit rate in 1972 was 7% of sales and that if the last ten years of GM dividend payments are reviewed it will be found that GM has been paying out about 70% of earnings. He said this compared favorably with Ford and with industry generally where income was about 4.3% of sales in 1972 with a dividend payout of 45% of income. Mr. Gerstenberg commented further that although Ford Motor is outselling GM overseas, and has been for a number of years, GM has earned more money from overseas operations than Ford. In regard to truck sales, Mr. Gerstenberg stated that Chevrolet truck sales are currently on a par with Ford and that the same situation applies to the sale of the Chevrolet Vega versus the Ford Pinto.

A stockholder then asked why car prices are higher in Canada than in the United States. The Chairman replied that it costs more to build and distribute cars at the lower volume in Canada. He went on to say that three or four years ago, the difference in car prices between the two countries was between 18 to 20%. Today, the difference is about 8 to 9% and that as the volume grows in Canada further progress will be made in reducing the differential. In answer to a question concerning a *Wall Street Journal* article that mentioned a General Motor Inn, Mr. Gerstenberg replied that since the name was General Motor Inn — not General Motors Inn— there was little GM could do about the name. Another question—dealing with a court decision that GM has infringed on a patent held by a company called Devex that covered a lubrication process used in making automobile bumpers —was answered by Mr. Malone who stated that the matter has been under litigation for a number of years. Two trial courts held that GM did not infringe on the patent, which expired in 1969, but that on appeal these decisions were reversed. GM's petition to the Supreme Court for review was denied. Mr. Malone stated that there will be an accounting of damages, with no great amount of

money involved.

A stockholder then mentioned that the 1972 Annual Report stated that 635,000 shares of GM common stock were acquired for employe plans, and asked if GM acquired additional stock for purposes other than employe plans. Mr. Gerstenberg replied that GM did not.

In answer to a series of questions raised by a stockholder, Mr. Gerstenberg stated that in 1972 GM spent about 10 cents a share for pollution control in its plants and about 30 cents per share for vehicle emission control. The vehicle emission control expenditure excluded costs of required product changes. The Chairman then stated that the cost of recalls during the last three years has been about 10 cents per share, but that during that three-year period GM earned about $17 per share. In answer to a question on what GM is doing to prevent an "industrial Watergate," Mr. Gerstenberg said there are security measures in each GM location and that employes are trained to observe strict security in all phases of their work and that much time and effort is devoted to protecting GM properties and its future plans and programs.

The general discussion relating to the business of the Corporation was concluded with a statement by a stockholder who urged the officers and directors to give serious consideration to an expanded public relations activity aimed at helping the general public understand the multiplicity of causes for air pollution and environmental problems and their solutions.

The Chairman then introduced the judges for voting at the meeting and proceeded to Part II of the Agenda — the first item of which was the election of directors.

Item 1—Election of Directors

The 25 nominees named in the Proxy Statement were nominated.

A proxyholder asked if any conflicts of interest existed with respect to the directors. The Chairman replied that there were no conflicts of any kind. He mentioned that in every instance the purchase of materials from companies with which Board members were affiliated was less than 1% of their sales, with the exception of one, the amount of which was disclosed in the Proxy Statement; and that deposits with individual banks with which Board members were affiliated were substantially less than 1% of their total deposits. The same proxyholder suggested that next year stockholders be advised as to the GM stock owned by banks affiliated with directors in either nominee name or in trust accounts. In response to other questions asked by the same proxyholder, Mr. Gerstenberg stated no employe director sits on any bank Board and that he saw no need to report the interest on a GM loan which might be made by a bank affiliated with an outside director.

Before proceeding to questions on the election of directors, a stockholder inquired as to the proposals omitted from the Proxy Statement. Mr. Gerstenberg replied that there were several: one on charitable contributions submitted by Evelyn Y. Davis; a proposal on disclosure of the ten largest stockholders made by Edward C. Calvert; and two submitted by Lewis Gilbert, Wilma Soss and their associates re-

lating to the Order of Business. He further stated that the proposal on charitable contributions was omitted because it received less than 3% of the vote at last year's meeting and that the other three proposals were withdrawn by the proponents.

In reply to a series of questions from the same stockholder, Mr. Gerstenberg said that he had no knowledge of the disposition of GM stock listed in the personal account of Mr. Charles Mott or of any action with respect to stock held by the Mott Foundation. The Chairman further replied that twelve directors' meetings were held during the past year and that the attendance fee paid to outside directors was $600 per meeting. He added that the fee is reduced to $100 a meeting if an outside director is a Committee member, and that as a member of a Committee, he receives a fee of from $9,000 to $16,500 a year, depending on the Committee. Employe directors receive no director fees. The stockholder commented that in the proper year he will again use the Proxy Statement to protest the amount of executive compensation.

A proxyholder asked whether Board members discussed the decision to buy platinum from South Africa. The Chairman answered that this decision was an operating decision, but that it was reported to the Board. Mr. Gerstenberg added that a source for platinum was limited to two choices—South Africa and the Soviet Union. Mr. Gerstenberg added that all members of the Board were disappointed in having to go outside the country to buy a material critical to GM's production.

A stockholder expressed dissatisfaction with C T Corporation System appointed to act as judges at the meeting and recommended that a New York bank be used in the future. The stockholder continued by stating her opinion that conflicts of interest and interlocking directorships exist among certain members of General Motors' Board of Directors.

A stockholder complimented management on the election of Miss Catherine B. Cleary to the Board of Directors but added that she was disappointed that Miss Cleary was closely identified with another corporation. Mr. Gerstenberg commented that much thoughtful consideration was given to the selection of Miss Cleary and that she is keenly interested in all of the business aspects of General Motors and also in what the Corporation is doing about employment of women. Mr. Gerstenberg further stated that Miss Cleary has put the Corporation in contact with a women's college engaged in important research projects with respect to upgrading women in business and that a good relationship has been established with this school. The Chairman stated that if GM directors are invited to serve on other Boards, this is an indication they are good directors.

A stockholder remarked that a director named in the Proxy Statement is a member of a law firm and asked whether General Motors is a client of this particular firm. The Chairman replied that he did not know whether the Corporation used the services of this law firm. (A subsequent check showed that General Motors is not a client of the firm in question.)

In response to a question on out-of-town Board of Directors' meetings, Mr. Gerstenberg said that

the Board normally meets in New York City and within the last year two meetings were held outside New York City—one in Detroit and one in Tokyo.

In response to a question asked by a stockholder on whether any director or officer of General Motors has made donations to a political committee formed by the Chairman of another company, Mr. Gerstenberg replied he would have no way of knowing the answer to this question.

The 25 nominees for directors named in the Proxy Statement were elected, with each director receiving a plurality of the votes cast. In accordance with the stockholders' directions, a total of 684,504 shares, owned by 8,654 stockholders, was not voted for directors.

Item 2—Board of Directors Proposal to Ratify the Selection of Independent Public Accountants

The proposal to ratify the selection by the Corporation's Audit Committee of Haskins & Sells as independent public accountants for the year 1973 was presented to the meeting, and the Chairman introduced representatives of Haskins & Sells.

Mr. Gerstenberg noted that the Audit Committee is composed entirely of directors who are not officers of General Motors or members of its Finance or Executive Committees. He also said the Audit Committee met seven times in the past year and that the Committee requires representatives of Haskins & Sells to be available to attend meetings both to answer any accounting questions which may arise and to discuss any matter that the accountants may wish to bring to the attention of the Committee. The Chairman stated this arrangement gives the Audit Committee a good continuing relationship and understanding both of the operation of the audit and of the thinking and recommendations of the auditors. The Audit Committee also invites the financial officers of the Corporation to attend its meetings.

In response to questions from a stockholder, Mr. Gerstenberg explained that GM has two internal audit groups—a divisional group in every operating division and a central office staff headed by an internal auditor. He noted that the internal auditor reports to the Vice President in charge of Finance and that during the course of the year, the internal auditor makes a presentation on the duties of the staff to the Audit Committee. This affords the Committee the opportunity to question the internal auditor on the controls that he is able to exercise through this internal audit function. In reply to a further question from the same stockholder, the Chairman said that all possible measures are taken to control all purchases by obtaining competitive bids, alternating people within the purchasing staff so that there will be no long-standing relationships at any time, and monitoring by the internal audit staff and the outside auditors.

In response to a question from a proxyholder, Mr. Gerstenberg said the fee paid to the auditors for the 1972 audit totaled approximately $2.3 million worldwide. The proxyholder asked a representative of Haskins & Sells to report on the law suits pending against his firm. The representative replied that there are no criminal indictments or Securities and Exchange Commission actions pending against either the people of Haskins & Sells or the firm

itself. In reply to a question from the same proxyholder, the representative of Haskins & Sells described the various aspects of generally accepted auditing standards and generally accepted accounting principles. He also gave examples.

A stockholder asked what was being done to prevent illegal political contributions from being funneled through banks and then being referred to as charitable contributions or sales promotions. Chairman Gerstenberg assured the speaker that both the Corporation's accountants and its internal auditors check on everything that is being done in this respect. The stockholder asked when the last income tax audit was concluded and whether there were any discrepancies. The Chairman replied that these audits are complete up to 1968 and that there was no discrepancy which could not be resolved.

A stockholder asked the number of employes assigned by Haskins & Sells to the General Motors audit. Chairman Gerstenberg replied that approximately 450 locations were audited last year and that at some time over the year approximately 1,500 were assigned to the GM audit, with as many as four to five hundred in any one single day. The same stockholder asked about the number of women employed in this group, to which a representative of Haskins & Sells replied that approximately 200 women are employed on the firm's professional staff in the United States, excluding the clerical people.

A stockholder complimented management on the clarity of its stockholder reports and stated that although he had no criticism of the present auditor's professional standards, he recommended rotation of auditors. The Chairman replied that there is a provision requiring a review every five years to determine whether or not auditors should be rotated. He added that rotation of auditors is fine in theory but a very difficult thing in practice. The Chairman further stated that Haskins & Sells rotates its partners serving on a particular assignment involving a GM audit every three years.

The proposal to ratify the selection of Haskins & Sells as independent public accountants for the year 1973 was approved by a vote of 234,846,022 shares for the proposal (99.78%) and 522,645 shares against the proposal (0.22%).

Item 3—Stockholder Proposal to List the Name of Each Director Nominee on the Proxy and to Provide a Means of Separate Voting on Each Nominee

The proposal to list the name of each director nominee on the proxy and to provide a means of separate voting on each nominee, submitted by Mr. Edward Calvert, was presented to the meeting. The Chairman stated that the General Motors Board of Directors favored a vote against the proposal for the reasons set forth in the Proxy Statement.

A stockholder spoke in support of the proposal and stated there was a need for the Securities and Exchange Commission to restudy the entire proxy mechanism. Another stockholder supporting the proposal remarked she was in favor of a secret ballot.

The proposal to list the name of each director nominee on the proxy and to provide a means of

separate voting on each nominee was defeated by a vote of 4,788,555 shares for the proposal (2.08%) and 225,467,603 shares against the proposal (97.92%).

Item 4—Stockholder Proposal to Require that Unmarked Proxies Not be Voted

The proposal to require that unmarked proxies not be voted, submitted by Messrs. Lewis D. Gilbert and John J. Gilbert and Mrs. Wilma Soss was presented to the meeting. The Chairman stated that the General Motors Board of Directors favored a vote against the proposal for the reasons set forth in the Proxy Statement.

In commenting on this proposal a stockholder stated that one reason most stockholder proposals receive less than 3% of the vote is because of the present method of counting unmarked proxies. The same speaker criticized the inspectors of election employed by General Motors.

Another stockholder spoke in favor of the proposal and asked what percentage of the proxy votes submitted were unmarked both with respect to the number of proxies submitted and the number of shares represented by the proxies. During the inspectors' report on the voting results, it was announced that of the proxies received, 56% were received unmarked representing 45% of the shares.

A stockholder praised the professional standards of the inspectors of election employed by General Motors and noted that they control the ballots from the first day that the proxies are received. The same stockholder spoke in support of the proposal under discussion.

The proposal to require that unmarked proxies not be voted was defeated by a vote of 5,411,405 shares for the proposal (2.35%) and 224,866,796 shares against the proposal (97.65%).

Item 5—Stockholder Proposal to Require that the Corporation Publish in its Annual Report Certain Information with Respect to Pedestrian Safety

The proposal to require that the Corporation publish in its Annual Report certain information with respect to pedestrian safety, submitted by Mr. Waldon Sieh, was presented to the meeting. The Chairman stated that the General Motors Board of Directors favored a vote against the proposal for the reasons set forth in the Proxy Statement.

A stockholder speaking in support of the proposal asked about the safety innovations introduced by GM. Mr. Gerstenberg mentioned the collapsible steering column and side-guard door beams as two very important safety measures pioneered by General Motors before there were standards with respect to either of them. The Chairman added that GM has constantly worked on the things that best control the car—the steering and the brakes—and that a long period of research with the tire companies has resulted in the recently announced new tire program.

A stockholder recommended including information such as pedestrian safety in a supplement to the Annual Report and also recommended making references to this subject in General Motors advertisements.

A stockholder supported management's position

on this proposal and stated that some pedestrian accidents are due to jaywalking and not observing traffic lights. The stockholder then commented that accidents of this nature are frequently as much the fault of the pedestrian as the driver.

In response to a stockholder inquiry, Mr. Cole expressed concern about the visibility problem experienced by drivers of trucks. He stated there was a recent proposed ruling in connection with this situation, where there is a specified angle of vision that is required from the driver's position over the front of the vehicle. Mr. Cole said that the Corporation is concerned with this problem and that General Motors has built a modified school bus showing the advantages of having the driver's downward view line very close to the vehicle and has submitted recommendations to the Department of Transportation.

A proxyholder asked for the names of the tire companies with which General Motors was working. Mr. Cole cited five principal sources: Goodyear, Uniroyal, Firestone, Goodrich and General. Mr. Cole mentioned the work which has been done with these companies in the research and development area to establish certain requirements for performance of the tires used on GM production cars. He added that the new tires referred to earlier by the Chairman would be reaching the market soon and that they are a great advancement in automotive safety.

A proxyholder spoke in favor of the proposal and expressed his view that the basic intent of the proposal is to put GM on the side of improved vehicle design for pedestrian safety in much the same way that the Corporation has contributed to air bag development. He criticized GM for returning to the use of hood ornaments which had been removed several years ago. Mr. Cole explained that the ornaments in question are the push-away type, that they are not rigid and that they offer no resistance to an individual who hits this ornament.

The proposal to require that the Corporation publish in its Annual Report certain information with respect to pedestrian safety was defeated by a vote of 3,008,130 shares for the proposal (1.31%) and 227,370,423 shares against the proposal (98.69%).

Item 6—Stockholder Proposal to Require that the Corporation Report on Political Contributions

The proposal to require that the Corporation report on political contributions, submitted by Mrs. Evelyn Y. Davis, was presented to the meeting. The Chairman stated that the General Motors Board of Directors favored a vote against the proposal for the reasons set forth in the Proxy Statement.

A stockholder in support of the proposal cautioned General Motors about the use of company stationery for political purposes. A stockholder then inquired if there was any General Motors officer who was an officer of a political party. Chairman Gerstenberg replied there was none of whom he was aware.

The proposal to require that the Corporation report on political contributions was defeated by a vote of 5,258,047 shares for the proposal (2.28%) and 225,036,452 shares against the proposal (97.72%).

Item 7—Stockholder Proposal to Report on Any Segregated Fund and Political Contributions

AND

Item 8—Stockholder Proposal to Report Communications to Federal Government and Memberships in or Contributions to Trade Associations

The above two stockholder proposals were submitted to the meeting by a representative of the Project on Corporate Responsibility, Inc. The Chairman stated that the General Motors Board of Directors favored a vote against these proposals for the reasons set forth in the Proxy Statement.

A speaker for the proposals inquired about General Motors' policy with respect to direct contributions in the area of referendums. Chairman Gerstenberg replied that there have been three instances in the last several years where the Corporation has made contributions to support a referendum. Two of them, involving transportation legislation, took place in New York, and the third, concerning legislation with respect to pollution and particularly with respect to General Motors plants, occurred in California.

The same proxyholder asked about General Motors' system of campaign fund contributions by employes. Mr. Gerstenberg described it as a two-envelope system. Employes place contributions in a sealed envelope, and indicate the candidate or political party to whom the contribution should be sent. The employe places this sealed envelope in one addressed to the auditing firm of Haskins & Sells. Mr. Gerstenberg noted that General Motors encourages its employes to be active in the political process and that this system is designed to maintain confidentiality of the individual's political choice. A stockholder commented that the two-envelope system is the same as she had proposed for the secret ballot.

A stockholder spoke against Item 8 on the basis that any individual who is a taxpayer has the right to communicate with government officials.

The proposal to report on any segregated fund and political contributions was defeated by a vote of 5,416,662 shares for the proposal (2.35%) and 224,976,844 shares against the proposal (97.65%).

The proposal to report communications to Federal Government and memberships in or contributions to trade associations was defeated by a vote of 4,393,826 shares for the proposal (1.91%) and 225,993,266 shares against the proposal (98.09%).

Item 9—Other Business

In reply to a stockholder's questions on automotive recalls, Mr. Gerstenberg stated that GM is continually reducing recalls and continually improving the procedures that govern recall campaigns. In answer to the stockholder's specific question regarding Pitman arms on 1959 and 1960 Cadillacs, the Chairman said that he was familiar with the alleged Pitman arm failure. He said that General Motors has provided the Department of Transportation with complete information on the Pitman arm situation, which is now under review at the Department. The information provided indicated that out of 260,000 to 280,000 Cadillacs built in 1959 and 1960, there have been only eight alleged

accidents that might have been caused by Pitman arm failure and that in only one of these did the owner allege anything more than minor damage. GM's testing showed that Pitman arm failures of the type reported could only happen when the car is going slow and the steering wheel is turned to put the wheels in a very cramped position, as when parking a car.

A proxyholder asked for information regarding problems that occurred with the Vauxhall Firenza car produced in England and imported into Canada. Mr. Murphy replied that this Vauxhall model had been marketed in Canada in 1971 and 1972 and that about 13,000 had been sold. Because of the low sales volume, the decision was made to discontinue its sale in Canada. There had been some problems with the vehicle and GM of Canada set up special procedures to see that every customer received satisfaction. A program was established that allowed owners of the Vauxhall Firenza to trade this car in on another GM model and receive an additional allowance of $250. In reply to additional questions from the proxyholder, Mr. Gerstenberg said that the gift of General Motors property to the city of Bristol, Connecticut, was an instance where it is in the best interest of the company to dedicate small parcels of land or donate buildings to the community in which GM operates. In regard to GM's aircraft, the Chairman stated that the cost to operate the 16 planes is under $10 million per year, and that the value obtained far exceeds the cost involved.

A stockholder complimented GM management on its operation of the Corporation, stating that it was hard to understand why certain groups continually badgered the management with self-centered proposals.

A proxyholder, who stated that the motor home produced by the GMC Truck & Coach Division was an impressive vehicle, asked why the same chassis design could not be applied to school buses so that the buses would have a lower center of gravity. Mr. Cole replied it would be difficult to lower the center of gravity on a school bus to the same degree as on the motor home because truck chassis are used for school buses as a matter of economy. School districts buy their buses on a bid basis and unless they can obtain a suitable school bus that meets their budget they will continue to run their old buses. This matter of economy is a critical factor in school bus safety, Mr. Cole stated, and GM supports any improvement in school bus configuration — whether it be seat belts, better vision over the front of the vehicle, etc. Mr. Cole also said that GM has found cases where drivers of school buses do not have suitable control of the vehicle, and GM has suggested the use of automatic transmissions, power brakes, power steering and the like in order to make the school bus safer. He mentioned that GM has worked closely with the Department of Transportation on the school bus situation and has submitted a list of items that in GM's judgment would make the school bus a safer vehicle. Mr. Cole concluded with the suggestion that the proxyholder, who is acquainted with persons at the Department of Transportation, make his feelings known directly to the Department with the idea that he might be

able to influence their thinking on school bus safety.

A stockholder, who also was a GM employe, charged that the Corporation made it difficult for employe-stockholders to attend annual meetings. Mr. Gerstenberg replied that GM has never denied any of its employe-stockholders the right to attend annual meetings, provided they considered the day as part of their vacation period.

A stockholder commented that GM should not be criticized for its operation in South Africa. He believed the South African Government was doing the best job it could for its nonwhite citizens and did not feel that the conditions of labor there could approximate the conditions of slavery that an individual attending the meeting had implied.

A stockholder, who commended GM on its dividend payments and profits, asked if there were any plans to reduce the overall size and weight of GM cars in view of the rising costs and diminishing gasoline supply and if the Corporation was considering a small, diesel-powered car in its future plans. Mr. Gerstenberg replied that it was not possible for GM to redesign all of its cars overnight to reduce weight, but that there are small cars available which GM is ready to sell at anytime. In reply to the question on diesel-powered cars, the Chairman said that GM has started limited production and sale of a diesel-powered Opel in Germany and is watching the results very closely from the standpoint of customer reaction and emissions.

A stockholder commented that in the interest of increased auto safety, GM should consider limiting the speed of its cars to 80 miles per hour. The Chairman stated that this has been considered in the past and that in view of the stockholder's suggestion it would be given more thought.

Mr. Gerstenberg then expressed his and management's appreciation to all stockholders for their support. He mentioned that the comments, suggestions and criticisms submitted by stockholders during the year are given close consideration and are helpful in shaping the future of the Corporation. The Chairman concluded by saying he hoped that at the 1974 Annual Meeting, he would again be able to report on a year of progress — progress for GM's customers, employes and its stockholders.

The 65th Annual Meeting of General Motors Stockholders then adjourned.

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